



MYRMECIA

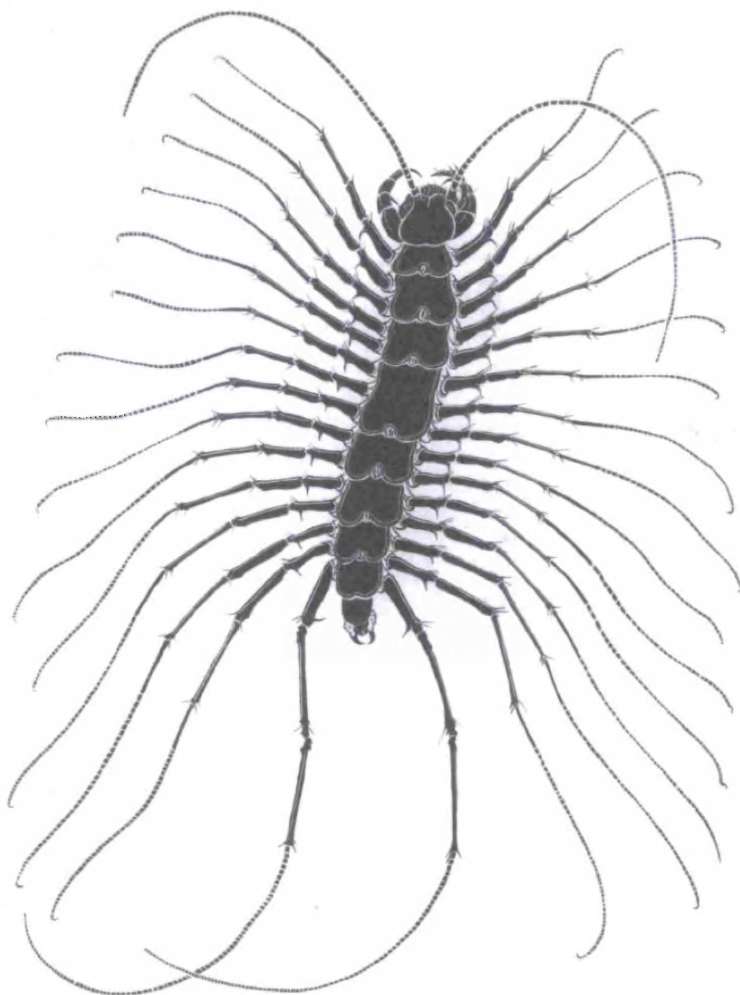


News Bulletin of the Australian Entomological Society Inc.

Volume 40, Part 3, July 2004

Australia Post Print Post Publication PP242296/00144.

Price \$5.50 (including GST) ISSN 1323-6032



AUST. ENTOMOL. SOC. EXECUTIVE ADDRESS
Australian Entomological Society Executive
c/- Department of Primary Industries
Private Bag 15, Ferntree Gully Delivery Centre
VIC 3156, AUSTRALIA

OFFICE BEARERS

President

James Ridsdill-Smith
CSIRO Entomology,
Private Bag No. 5, PO Wembley,
Western Australia 6014
james.ridsdill-smith@csiro.au

Vice President

Dr P.M. Ridland
c/- Executive Address above
Ph (03) 9210 9222
Fax (03) 9800 3521
Peter.Ridland@dpi.vic.gov.au

Secretary

Ms N.M. Endersby
c/- Executive Address above
Ph (03) 9210 9222
Fax (03) 9800 3521
Nancy.Endersby@dpi.vic.gov.au
Nancy.Endersby@sci.monash.edu.au

Treasurer

Mr I.D. Endersby
56 Looker Rd
Montmorency VIC 3094
Ph (03) 9435 4781
Fax (03) 9435 4781
endersby@mira.net

Public Officer

Dr E. Jane Wright
CSIRO Entomology
GPO Box 1700 Canberra ACT 2601
Ph (02) 6246 4183
Fax (02) 6246 4202
jane.wright@csiro.au

Promotions Officer

Dr Glynn Maynard
AFFA
GPO Box 858
Canberra ACT 2601
Ph (02) 6272 3544
glynn.maynard@affa.gov.au

Chief Editor

Dr Peter Allsopp
Manager - Special Projects
Bureau of Sugar Experiment Stations
PO Box 86 Indooroopilly Qld 4068
Ph (07) 4132 5200 Fax (07) 4132 5253
Mobile 0408182614 email pallsopp@bses.org.au

Technical Editors

Dr A.L. Bishop
Horticultural Research Station
Box 26 Gosford NSW 2250
Ph (02) 4348 1928
Fax (02) 4348 1910
alan.bishop@agric.nsw.gov.au

Dr K.L. Walker
Museum Victoria
GPO Box 666E
Melbourne Vic 3001
Ph (03) 8341 7432
Fax (03) 8341 7750
kwalker@musem.vic.gov.au

Dr A. Andersen
CSIRO Wildlife & Ecology
Tropical Ecosystems Research
Centre
PMB 44, Winnellie NT 0821
Ph (08) 8944 8431
Fax (08) 8944 8444
Alan.Andersen@csiro.au

A/Prof GM Gurr
Faculty of Rural Management
University of Sydney
PO Box 883 Orange NSW 2800
Ph (02) 6360 5551
Fax (02) 6360 5590
ggurr@orange.usyd.edu.au

PATRON

His Excellency, Major General Michael Jeffery AC
CVO MC, Governor-General of the Commonwealth
of Australia

SOCIETY SUSTAINING ASSOCIATES

Integrated Pest Management (Bugs for Bugs)

THE COVER

Kath White, Newcastle
University, was awarded
a prize at Hobart in the
AES Insect Illustration
competition for this
drawing of a centipede.

COUNCILLORS

Queensland

Ms Kerrie Huxham
NAQSAQIS
Centre for Tropical Agriculture
PO Box 1054
Mareeba QLD 4880
Ph (07) 4048 4600
Fax (07) 4092 3593
kerrie.huxham@aqis.gov.au

Ms Jane Royer
Qld Dept Primary Industries
21 Redden St
Cairns QLD 4870
Ph: (07) 4044 1640
jane.royer@dpi.qld.gov.au

Ms Bronwyn Walsh
Queensland Horticulture
Institute
Dept Primary Industries
Gatton Research Station
Locked Bag 7, MS 437
Gatton QLD 4343
Ph (07) 5466 2222
Fax (07) 5462 3223
Bronwyn.Walsh@dpi.qld.gov.au

Papua New Guinea

Dr Lastus Kuniata
Ramu Sugar Ltd
P.O.Box 2183, Lae 411
Papua New Guinea
Ph 675 474 3299;
Fax 675 474 3295
lkuniata@ramusugar.com.pg

South Australia

Glenys Wood
SARDI
GPO Box 397
Adelaide SA 5001
Ph (08) 8303 9660
Fax (08) 8303 9542
Wood.glenys@saugov.sa.gov.au

Tasmania

Simon Grove
Conservation Biologist
Forest Research & Development
Forestry Tasmania
GPO Box 207
Hobart Tas 7001
Ph (03) 6233 8141
Fax (03) 6223 8292
simon.grove@forestrytas.com.au

Victoria

Dr Linda Thomson
CESAR
La Trobe University
Bundoora Vic 3083
Ph (03) 9479 2256
L.Thomson@latrobe.edu.au

Western Australia

Dr Tara Simmul
Serve-Ag, WA
11A Pike Street
Karrinyup WA 6018
Ph 0407 295 171
tara.mendham@tpg.com.au

Australian Capital Territory

Mr Kimberli Pullen
CSIRO Entomology
GPO Box 1700
Canberra, ACT, 2601
Ph (02) 6246 4263
Fax (02) 6246 4364
kim.pullen@csiro.au

New South Wales

Mr Aaron Simmons
The University of Sydney,
Orange
PO Box 883
Orange NSW 2800
Ph (02) 6360 5630
Fax (02) 6360 5626
asimmons@orange.usyd.edu.au

Dr Alan Clift
Department of Crop Sciences
University of Sydney
NSW 2006
Ph (02) 9351 2938
Fax (02) 9351 7504
clifta@agric.usyd.edu.au

Northern Territory

Dr Tracy Dawes-Gromadzki
CSIRO Tropical Ecosystems
Research Centre, PMB 44
Winnellie NT 0822
Ph (08) 8944 8400
Fax (08) 8944 8444
tracy.dawes-
gromadzki@csiro.au

SOCIETY REPRESENTATIVES

Entomological Society of New South Wales

E.E. Taylor
5 Endeavour Avenue
La Perouse
NSW 2036

Entomological Society of Queensland

Dr Jenny Beard
Department of Zoology & Entomology
University of Queensland
St Lucia QLD 4072

Entomological Society of Victoria

Mr Ian Endersby (acting)
56 Looker Road
Montmorency VIC 3094
Ph (03) 9435 4781
endersby@mira.net

SOCIETY HONORARY MEMBERS

Dr B.R. Champ
Dr I.F.B. Common
Dr C.N. Smithers

MACKERRAS MEDALLISTS

1984 Dr J.A.L. Watson
1986 Dr R.W. Sutherst
1988 Dr T.R. New
1990 Dr R.A.I. Drew
1992 Dr E.S. Nielsen
1996 Dr M.P. Zalucki
2000 Dr P.G. Allsopp
2002 Dr G.P. Fitt

IMMEDIATE PAST PRESIDENT

Prof. A.D. Austin
University of Adelaide,
Waite Campus, Private Mail Bag 1,
Glen Osmond, South Australia 5064

SOCIETY WEB SITE

[http://www.agric.nsw.gov.au/Hort/ascu/myrmecia/
myrmecia.htm](http://www.agric.nsw.gov.au/Hort/ascu/myrmecia/myrmecia.htm)

MYRMECIA EDITOR

Laurence Mound
laurence.mound@csiro.au

ASSISTED BY:

Tish Silberbauer: tsilberb@bio.mq.edu.au

CONSERVATION COMMITTEE

The Vice President & Secretary are *ex officio*
members of the Conservation Committee

Convenor

Dr R. V. Gunning
Ph (02) 6763 1128
Fax (02) 6763 1222
rgunning@enternet.com.au

Prof Jonathan Majer (WA)
Ph (08) 9266 7041
Fax (08) 9266 2495
J.Majerj@curtin.edu.au

Dr T. New (Vic)
Ph (03) 9479 2247
Fax (03) 9478 1551
T.New@zoo.latrobe.edu.au

Claire Stephens (SA)
Ph (08) 8303 7276
Fax (08) 8379 4095
claire.stephens@adelaide.edu.au

Dr A. N. Andersen (NT)
Ph (08) 8944 8431
Fax (08) 8944 8444
Alan.Andersen@csiro.au

Dr D. P. Sands (Qld)
Ph (07) 3214 2803
Don.Sands@csiro.au

Printed by:

GOANNA PRINT
151-155 Gladstone St.
Fyshwick ACT 2609
Fax (02) 6280 7369

Distributed by:

Blackwell Publishing Asia
550 Swanston St
CARLTON VIC 3053
Ph (03) 9347 0300



MYRMECIA WEB ADDRESS:

<http://www.agric.nsw.gov.au/Hort/ascu/myrmecia/myrmecia.htm>

CONTENTS

Australian Capital Territory	4
New South Wales	8
Northern Territory	14
Queensland	16
South Australia	23
Tasmania	28
Victoria	29
Western Australia	30
Membership Nomination Form	35

NOTICE

Statements made in *Myrmecia* do not necessarily represent the views of the Australian Entomological Society. Items printed herein should not be reproduced without permission of the editor.

EDITORIAL

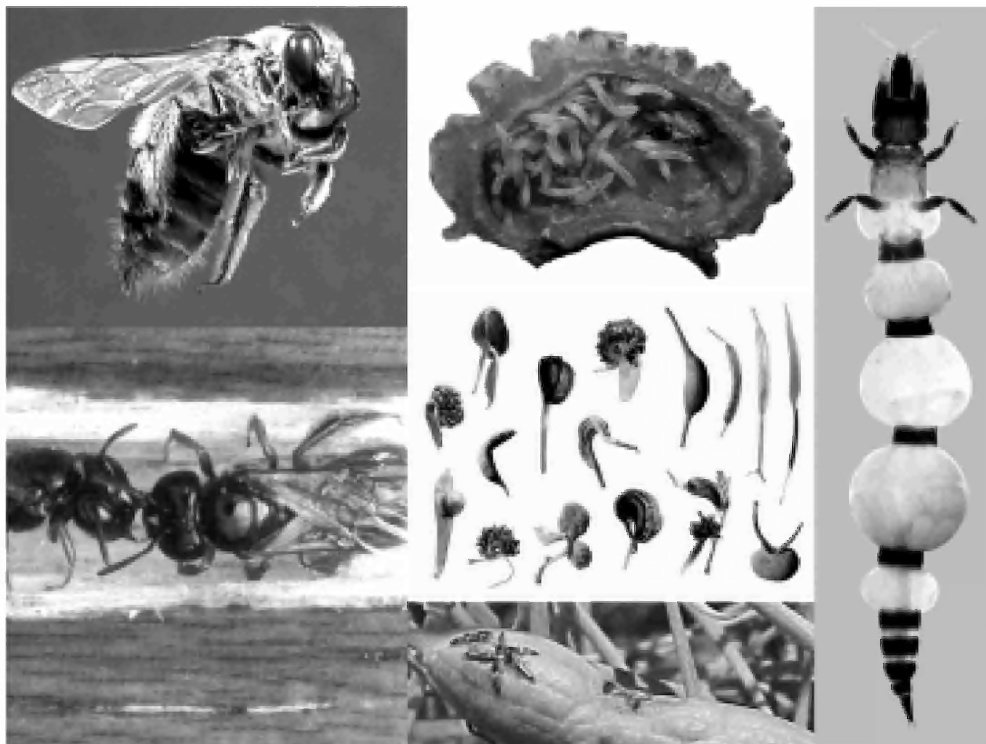
Welcome to ICE2004 Brisbane. This edition of the *News Bulletin* of the Australian Entomological Society has been prepared in an attempt to provide delegates to the XXII International Congress of Entomology with an overview of work on insects across this vast continent. Material has been submitted by colleagues throughout Australia, although by no means from all research groups that are active in this field. Many entomologists are often too busy working to find time to communicate the general interest of their work – a characteristic that recurs among scientists across the world, and is one reason why science is sometimes poorly funded and we are accused of keeping society insufficiently informed of our activities. Be that as it may, the contents of this issue of *Myrmecia* indicate a



Myron Zalucki

Chair of ICE2004 Executive

remarkable breadth of work on insects by AES members – ecological, evolutionary and economic, using a diversity of techniques from radar to molecules, and not forgetting that time-honoured technique of sitting, watching and recording through which we learn so much about our world. The land area of Australia almost equals that of the USA – thus we have the same problems of distance. But the low carrying capacity of most of our soils and the low rainfall result in a low population of most organisms – insects often being an exception. But even insects are subject to these ecological constraints, and one of the most obvious characteristics both of Australian weather and of our insect populations is unpredictability. As a result, remarkably little is known of the biology of so many insect species – it is not possible to start a PhD student looking at an insect species that was abundant



Australia has a megadiverse fauna of bees,
and physogastric thrips are found only on this continent
<http://www.scieng.flinders.edu.au/biology/people/schwarz_m/mps/mpspersonnel.htm>
<<http://www.worldwidewattle.com/infogallery/misc/thrips.php>>

this year if there is a high probability that it will be difficult to find for the next three years. Despite such problems, the interest and diversity of the Australian insect fauna is very evident. And remember that the "Australian fauna" has at least four major components: the northern wet tropics, the central arid regions, the cold wet areas of the South East – and the agricultural areas with all their introduced insect species. Welcome, therefore, to diversity. The members of the AES hope that delegates enjoy their visits, and if you wish to make contact with anyone mentioned in these pages then we will be happy to help.

To AES members I must point out that this will be the last issue of *Myrmecia* that I expect to prepare. As I wrote to our Secretary, I think that it is time the Society benefited from a fresher viewpoint than that of a 70 year-old. **Tish Silberbauer** is thus expected to take responsibility at the AGM in Brisbane, our respective scientific interests in

haplo-diploid insects being reflected in the accompanying picture (supplied by Mike Schwarz' lab at Flinders University).

LAM

Elwood Curtin Zimmerman 1912 - 2004

Our famous, and much-respected colleague, known to all of us as Zimmie, collapsed on Wednesday 16 June 2004, from a massive stroke while at work examining a fresh consignment of weevils at his home at Merimbula on the New South Wales south coast. He died without regaining consciousness in the early hours of Friday 18 June. At 92 years of age he had been actively working for some 70 years. He leaves his wife Hannah who lives at Nullica Lodge, Alms Street, Eden, NSW, 2551. At his request there was to be no funeral or memorial service, only a simple burial at sea on the edge of Australia's continental shelf overlooking

the Pacific Ocean around which he had spent most of his entomological life. Zimmie was author of nine volumes of "Insects of Hawaii" and five volumes of "Australian Weevils" as well as some 200 scientific papers – a world record for a single author.

Australian Entomological Society Inc.

Banks and Solander collected the first Australian insects at Botany Bay in April 1770 thus beginning an interest in Australian entomology. The logo of the Australian Entomological Society features the red bull ant *Myrmecia gulosa* (Fabricius, 1775), one of the first Australian insects to be formally named. Banks collected the first specimen in 1770 and it still exists in good condition in the Natural History Museum, London.

The Entomological Society of New South Wales was the first entomological society to be established in Australia (1862-1873). A further three entomological societies under five names came into existence in this state between 1921 and 1962, the present one being inaugurated in 1980.

The Entomological Society, Brisbane, was another early-established society (1923 mainly on the initiative of GHH Hardy). One of its main objectives was to instigate the formation of an Entomological Society of Australia and to publish a national journal. It changed in 1926 to its current name, the Entomological Society of Queensland.

Victorian entomologists formed The Entomologists' Club which held its first meeting on 5 April 1927, the name being amended to The Entomological Society of Victoria in June 1935. Membership dropped during the Second World War and the Society lapsed around July 1942. The efforts of JC Le Sueuf resulted in the society being re-established in 1961. The inaugural meeting of The Australian Entomological Society was held on 17 August 1965, during the Australian and New Zealand Association for Advancement of Science Congress in Hobart. At that time 285 entomologists had applied for membership (269 became Foundation Members) and the local societies in Queensland, New South Wales and Victoria had applied for affiliation. The Hobart meeting elected the first officers of the Society - IM Mackerras (President), EN Marks (Vice-President), AWS May (Secretary), GHS Hooper (Treasurer) and BR Champ (Editor). The objective of the Society is the advancement and dissemination of entomological knowledge in all its aspects, particularly, but not exclusively, in relation to the Australian fauna. The Society was incorporated in 1971.

Publications. The first headquarters of the Society were set up in Brisbane. The publication of a News Bulletin established communication between members of the Society. CN Smithers was editor of the first issue which was produced in Sydney in November 1965. The name of the publication was changed to *Myrmecia* in 1989.

The Journal of the Entomological Society of Queensland was first published in March 1962. Negotiations between Officers of the newly formed Australian Entomological Society and the Council of the Entomological Society of Queensland led to the signing of an agreement on 1 August 1966, whereby the Queensland Society transferred its Journal to the Australian Society. The first issue of the Journal of the Australian Entomological Society appeared in 1967, as Volume 6, with BR Champ continuing as Editor. Discussion on a change in name for the Journal took place during the AGM in Adelaide in 1994. A postal ballot of members resulted in a majority vote for the name to be changed to the Australian Journal of Entomology. The new name and format appeared with Volume 35, Part 1, 1996, with PG Allsopp continuing as Chief Editor. Blackwell Publishing Asia has published the Journal since 1998.

Society Awards. The Mackerras Medal is the Australian Entomological Society's most prestigious award and is presented every two years to a member under 50 years of age who has demonstrated excellence in entomology. The award is named in honour of Ian Mackerras, the Society's first President and an entomologist who embodied the excellence in entomological pursuits that the award recognises.

A prize to encourage scientific writing, known as the Student Research Award was initiated in 1975. At the 39th Council Meeting (July 1990) it was decided that henceforth the name of the award would be 'The Phil Carne Prize', in honour of Dr Phil Carne who died in December 1989.

ICE 1972. The Australian Entomological Society was the national host for the XIV International Congress of Entomology (Canberra, 1972) and is proud to be hosting the XXII International Congress of Entomology in Brisbane in 2004.

President James Ridsdill-Smith. Our President grew up in the UK and joined CSIRO Entomology in 1964. He spent 13 years in Armidale NSW working on pasture scarabs, and is a foundation member of the Australian Entomological Society. He attended one of the first AGMs camping with Richard Milner and their families on the Gold Coast. In 1977 he moved to Perth working on dung beetles, red-legged



James Ridsdill-Smith
President AES 2000-2004

earth mites and aphids, but has increasingly been involved in management of research as a member of the Senior Leadership Team in CSIRO Entomology and as a consultant with the Grains Research and Development Corporation.

AES Core Executive. In 2004 the incoming Core Executive of the Society will be based at Orange, NSW, with **Murray Fletcher** (vice-president), **Geoff Gurr** (Secretary) and **Graham Thwaite** (Treasurer).

AUSTRALIAN CAPITAL TERRITORY

Australian Biological Resources Study

Studies supported by the Australian Biological Resources Study (ABRS) are a major contribution to knowledge of Australian insects and other arthropods. Since late 1973, when the Commonwealth Government of Australia disbursed the first 38 grants in this farsighted program, ABRS has funded original research on Australia's flora and fauna, and more recently, fungi and protists as well.

The initial remit of ABRS was establishment of 'a biological survey of Australia's birds, mammals and

reptiles and their ecology', and of 'a national collection of wildlife species', but objectives have evolved over the 31 years. The goals now include documentation and dissemination of information on Australia's biodiversity, through traditional printed matter as well as electronically on CD and online on the world-wide-web, and training in taxonomy. ABRS has two major arms, the grants or 'Participatory Program' and the 'Publications Program'. Details are available on our website at www.deh.gov.au/biodiversity/abrs/.

Another key activity for ABRS is providing an Australian interface for international projects such as the Global Biodiversity Information Facility and the Global Taxonomy Initiative. GBIF's mission is to make the world's primary data on biodiversity freely and universally available via the Internet. ABRS hosts the Australian participant node for GBIF, and our role is to develop an Australian portal through which both State and Commonwealth biodiversity data will be facilitated. This new initiative will enhance integrated national and international access to Australia's biodiversity data by governments, scientists, educators, land managers and community groups and individuals. The data portal will provide access to checklists of species names and allows for searching the data-base for specimen data. There are currently just three Australian GBIF data providers but several more are planned to come online in the next few months. (See www.deh.gov.au/biodiversity/digir/).

The Participatory Program

Under this program, funds are made available for original taxonomic work on the Australian biota; development of useful 'Biodiversity Products' such as identification guides, checklists or books; and for training in taxonomy through scholarships and bursaries. Annually, applications are invited through a national newspaper advertisement and through the ABRS' website and publication *Biologue*, for research and 'biodiversity product' proposals, for a PhD scholarship, and for student travel bursaries. Specific program objectives are usually defined, set in accordance with the Australian Government's National Research Priorities. Each year's grant and scholarship applications are reviewed externally, ranked by the ABRS Scientific Advisory Committee and awarded by the Minister for the Environment and Heritage. Projects may be funded for up to three years; the PhD scholarship is for three years; travel bursaries are towards attendance of postgraduate students at conferences relevant to their taxonomic studies. Details

are available on the ABRs website (see Administration and Funding). Innumerable taxonomic papers and monographs on Australian fauna have resulted from studies supported under this program, as well as checklists and keys. As well as entomological works, much of the work on the flora is useful to entomologists concerned with phytophagous insects, quarantine and biosecurity.

ABRS Publications Program

Until recently, the published volumes of the *Zoological Catalogue of Australia* were one of ABRs' core products. These have been valuable handbooks for many entomologists worldwide. However, whilst most of the volumes are still available the series has now been supplanted by ABRs' online database, the *Australian Faunal Directory*. This database includes all the data from the published catalogues, most of it updated, as well as many groups not available in those printed volumes. And for workers on phytophagous insects, many of the volumes in the *Flora of Australia* series have now been databased and are accessible online. Most names in the ABRs online databases can be accessed via standard web search engines. In collaboration with the taxonomic community, ABRs is working continually to add to, update and upgrade its databases.

An ABRs' goal is to make available useful tools for identification and management of Australia's biodiversity. Thus, it seeks partnerships to development and publish identification keys and guides to the fauna and flora. Among recent such products of value to entomologists are Lucid Interactive keys on CD for *Mites in Soil* and *Spiders of Australia*, Eucalypts, and Australian *Acacia* and grass species; and online keys to nematodes. Among other keys currently under development in partnerships with ABRs are a Lucid key to Diptera families in Australia and a key to Australian centipedes. Occasional publications from ABRs include hard copy books, such as the recently released *Evolution of Ecological and Behavioural Diversity: Australian Acacia Thrips as Model Organisms* (order form on the ABRs website) and the soon-to-be-released *Australian Psylloidea: jumping plant lice and lerp insects*. Similar publications may result from future applications for project grants under the ABRs Participatory Program.

Australian National University Research School of Biological Sciences

Our research on the honeybee aims to elucidate the complex links between brain and behaviour

using a multi-level approach and collaboration between several laboratories. Behavioural aspects of honeybee learning and memory are investigated by **Mandyam (Srini) Srinivasan, Shaowu Zhang** and colleagues. They use bioassays to explore perceptual and 'cognitive' capacities of honeybees, such as pattern, object, and scent recognition, abstract rule learning, associative learning and cross-modal recall, and use field experiments to examine principles of honeybee vision, navigation, and flight control. Shaowu, Srini and colleagues also investigate the cellular mechanisms that underlie honeybee behaviour and memory formation. They explore the olfactory and visual stimulus-related events in the honeybee brain and neural mechanisms involved in the development and learning behaviour of the honeybee using optical imaging techniques. The effects of learning on the brain are also examined on a neuroanatomical and neurophysiological level. At the molecular level, **Ryszard Maleszka** and colleagues are investigating how gene function translates to phenotype, in particular behaviour. They are taking advantage of easily manipulable adult development and high mnemonic fidelity of the honeybee to unravel molecular changes occurring in the brain during behavioural maturation and learning. Using genome-based strategies they screen for transcripts whose expression is modulated by training or behavioural transition, determine their primary structures and assign functional significance. Maleszka's lab is part of an international effort to sequence and annotate the honeybee genome. The honeybee research teams include **Andrew Barron, Charles Claudianos, David Guez, Adrian Horridge, Michael Ibbotson, Robert Kucharski, Ryszard Maleszka, Judith Reinhard, Ulrike Schroeter, Mandyam Srinivasan, Maria Vidovic, Shunpeng Wang, and Shaowu Zhang**. <<http://cvs.anu.edu.au/index.html>> and <<http://www.rsbs.anu.edu.au/content/research%20groups/Visual%20Sciences.asp>>

School of Botany and Zoology

Michael Jennions' group is currently investigating the breeding behaviour of the black field cricket *Teleogryllus commodus*. At present our research has two main strands. First, we are interested in the genetics of fighting ability (success in male-male competition) and attractiveness (success through female choice). We are conducting artificial selection experiments to determine whether male-male competition and female choice select for different male traits. We are testing whether there

is a negative genetic correlation between attractiveness and fighting ability (antagonistic pleiotropy). If so, this may lead to balancing sexual selection that maintains heritable genetic variation in specific sexual traits, because selection for fighting ability reduces attractiveness and vice-versa. We currently have 4 replicates of 5 selection lines. Each replicate comprises: a line in which we select for fight winners; a line in which we select for fight losers; a line in which we select for attractive males (fast maters); a line in which we select for ugly males (slow maters); a control line in which we pick males randomly. Selection involves rearing up each generation, then taking 80 males and selecting 20 (depending on the selection line criterion) to sire the next generation.

Second, we are investigating why females mate more than once. We are testing whether multiple mating: increases egg hatching success, various measures of offspring performance (e.g. growth, survival), or the mating success of sons or fecundity of daughters; allows females to use post-mating mechanisms to selectively fertilize eggs with genetically more compatible sperm; is simply a way to ensure that females have sufficient sperm to fertilize their eggs; is due to females actively choose to mate with several males, or whether they are equally happy mating repeatedly with the same male. We have also completed studies looking at the effect of male attractiveness and dominance on female lifetime fecundity (to test for sexual antagonism) and we are involved in on-going studies with **John Hunt** and **Rob Brooks** (UNSW) investigating the life history trade-offs between investment in sexual advertisement and survival.

CSIRO Entomology

The largest single employer of entomologists in Australia, CSIRO Entomology has its headquarters in the ACT at Canberra, but some staff are found in most States and a few are employed overseas.

CSIRO Mexican Field Station

On 1 May 2004, CSIRO Mexican staff commemorated their 20th anniversary of operation. Officer-In-Charge, **Ricardo Segura** gave a presentation of the station's history, activities and achievements to local and Australian visitors. The Australian Ambassador to Mexico, Graham Wilson, came down from the capital, and **Joanne Daly**, Chief of CSIRO Entomology, also visited. Joanne took advantage of her attendance at a Global Biodiversity Information Facility meeting to catch up with the most geo-

graphically remote of her staff. This is the first time a Chief has visited the station. The other locally engaged staff member **Moises Martinez**, as well as Australian supervisor of the station, **Tim Heard**, attended. Previous staff members, **Manuel Juarez** and **Paty Juarez**, and technocrats from the Mexican governments departments that grant the permits to undertake operations in that country also enjoyed the event.

The station is situated in the port city of Veracruz, on the Gulf of Mexico. We rent a house with a large garden, glasshouse and shade houses. The house serves as laboratory, office, insectary, insect and plant collection, and residence for one staff member who acts as a caretaker. A field plot in a nearby village allows more field based work to be undertaken.

Much of the work of the station has focused on study of the ecology and natural enemies of plants native to this region that have become weeds in Australia, such as *Mimosa pigra* and *Parkinsonia aculeata*. Surveys of natural enemies of the plants are undertaken often requiring travel to other countries in the region. Agents that appear to be high priorities for biocontrol are taken to the station for studies of biology, rearing and host specificity. Agents that pass this preliminary screening are sent to Brisbane quarantine for further evaluation.

PhD Students

Various PhD students work within CSIRO, supervised in collaboration with various universities. The project of **Katarina M Mikac** is in collaboration with the University of Canberra, and is titled: "Gene flow, genetic structure and colonisation history in invasive populations of *Liposcelis* species (Psocoptera: Liposcelidae)". She investigates the invasion biology of Psocid populations associated with Australian grain storage systems. Through the use of Randomly Amplified Polymorphic DNA (RAPD) and microsatellite makers this project aims to investigate and compare the invasion ecology of three *Liposcelis* species, *Liposcelis bostrychophila* Badonell, *L. decolor* (Pearman) and *L. entomophila* (Enderlein). To date, RAPDs have been used to genotype national and international populations of *L. bostrychophila* to determine the geographic origin and colonisation events responsible for their introduction to Australia. In addition, 12 variable microsatellite loci have been isolated and optimised for *L. decolor* and *L. entomophila* and will be used to investigate the gene flow, genetic structure and colonisation history of these species. As there is limited information available on

the invasion ecology of *Liposcelis* species, molecular techniques such as RAPDs and microsatellites may provide powerful insights into the invasion processes of these important economic pests in Australia.

Post-doctoral Students

Many postdocs work within CSIRO, at various sites across the continent. **Ros Blanche** is just completing a 3-year CSIRO Postdoc Fellowship on the services and dis-services of rainforest insects to crops in north Queensland. The project first examined the state of knowledge about services and dis-services of rainforest insects in north Queensland crops. This initial survey formed the basis for the design of seven case studies to fill gaps in knowledge about impacts of rainforest insects in crops. All case studies compared crop sites near and far from rainforest to enable the likely natural habitat of the insects to be determined. These studies were: Custard apple pollination; Macadamia weevil parasitoids; Peanut pollination study; Macadamia pollination study; Lychee flower visitor study; Longan pollination study; Predator study – with the aim of determining whether there are differences in the number and kinds of insects that prey on other insects (i.e. potential bio-control insects) near and far from rainforest.

Tropical Weeds Research

This team undertakes research on biological control of weeds and integrated weed management as part of natural resource management. Our target weeds are all Weeds of National Significance and include *Parkinsonia aculeata*, *Mimosa pigra*, *Prosopis* species, *Alternanthera philoxeroides* and *Cabomba caroliniana*. **Reiks Van Klinken** recently visited mesquite field sites in Western Australia after flooding and cyclonic conditions. **Shon Schooler**, new postdoc researching alligator weed and cabomba with **Mic Julien**, visited collaborators in Argentina and Brazil in the search for new biological control agents. We are hoping for support to begin host specificity testing of alligator weed insects this year. Mic Julien and Shon are organizing a workshop on alligator weed for the Weeds CRC. New Zealand collaborators **Quentin Paynter** and **Imogen Bassett** will attend. **Di Taylor** visited field sites in the NT assessing impacts of the mimosa moth *Neurostrotia* on *Neptunia* as part of her Weeds CRC PhD study on off-target damage. **Shaun Kolomeitz** has developed an eco-climatic suitability model for Buffel grass and has established field validation sites to verify regional scale

models as part of his Weeds CRC PhD program.

Australian National Insect Collection Canberra Research.

Marianne Horak is currently focused at the generic level in economically important olethreutine tortricids and phycitine pyralids in which the higher classification has heretofore been purely superficial, including a project with **Felix Sperling** and **Frances FitzGibbon** on tortricid phylogeny based on DNA. **Ted Edwards** is resolving the Castniidae down to species level, a group of moths important to conservation. **Il-Kwon Kim** and **John La Salle** are studying the reversal to phytophagy in those Eulophidae that induce galls on *Eucalyptus*, one of which is now an invasive pest through the Mediterranean Basin, and **Nicole Fisher** and **John La Salle** are producing an electronic key to parasitoids of invasive leafminer pests in SE Asia. **Nai-Quan Lin** is doing a generic revision of Australian Mymaridae. **David Yeates** and **Christine Lambkin** are studying Therevidae systematics and evolution as part of an NSF PEET grant. **Joanna Hamilton** is coordinating activities for an ABRS-funded *Lucid* key to fly families of Australia, *On-The-Fly*. **Don Colless** is working on tachinid taxonomy, species concepts, and providing expert help with the fly key. David and Christine will be involved in a 4-day workshop after the Congress of Entomology to coordinate the activities of the Dipteran Tree of Life Grant, FLYTREE. **Rolf Oberprieler** is continuing with work on the late **Elwood Zimmerman's** monumental monograph series *Australian Weevils*, aiming to complete the volume on broad-nosed weevils (Entiminae) as soon as possible. He is also studying the phylogenetic relationships of *Tranes* weevils that pollinate Australian cycads. **Adam Slipinski** is working at revisions of Australian Coccinellidae, as well as studying various other families. **Laurence Mound** continues various studies on thrips, ranging from evolutionary studies (as in a recently published book on *Acacia* thrips diversification with **Bernie Crespi** and **David Morris**) to pest identification problems (as in a new cd-rom to be issued at ICE2004 on worldwide pest thrips with **Gerald Moritz** that is in English, German and Spanish, and includes a novel molecular identification system that is effective with eggs and larvae).

Bioinformatics. This year ANIC has gone live as a GBIF data provider; we are one of three Australian institutions listed by GBIF as official data providers. An updated version of BioLink (2.0) was released this year, and is available through the BioLink website, and a world list of Thysanoptera should

be on the web in early 2005.

New Books. Two new books on Australian insects have appeared this year: **Andersen NM & Weir TA** 2004 *Australian Water Bugs* (Hemiptera: Heteroptera; Gerromorpha and Nepomorpha), *Their Biology and Identification*. **Crespi BJ Morris DC & Mound LA** 2004 *Evolution of Behavioural and Ecological Diversity: Australian Acacia Thrips as Model Organisms*. The next volume of 'Monographs on Australian Lepidoptera' on the Australian zygaenids by **Gerhard Tarmann** is in press, illustrated with paintings by **František Gregor**.

Volunteers. The ANIC volunteers and honoraries received the CSIRO "Service from Science Award 2003" in recognition of their dedication to the Collection and the amount of time they donate towards its upkeep. The achievements and impact of this work are impressive; what is more impressive is that these people are donating their time and effort out of their dedication to describing, classifying and managing our insect biodiversity. The benefits also serve the many organisations and researchers who use ANIC.

Type database. ANIC has just completed an electronic list of its approximately 15,000 primary types. This list is due to be available through the ANIC Website in the near future.

Visitors and Students. ANIC has many visitors each year. **Felix Sperling**, University of Alberta, is visiting the Lepidoptera section and working with Marianne Horak on molecular and morphological phylogeny of Tortricidae. **Lin Nai-Quan**, Fujian Agriculture & Forestry University, is visiting John La Salle and studying systematics of egg parasitoids. Our PhD students include **Andreas Zwick** (Lepidoptera), **Chris Palmer** (Mecoptera), **Il-Kwon Kim** (Hymenoptera). We are currently hosting two ANU Honours Students, **Dave Carlisle** working on the taxonomy and ecology of stiletto flies, and **Rohan Wilson** looking at fly diversity on rainforest faunas of the Wet Tropics of Queensland.

NEW SOUTH WALES

Australian Museum

This year has been one of many changes. Entomology and the Centre for Biodiversity and Conservation Research are moving out of our temporary (15 years +) accommodation in the Yurong St. Annex and into a refurbished area in the main building of the Museum. Unfortunately this had to coincide ICE2004, but we hope that the collection will be accessible to visitors by at least the end of the

Congress. There have been changes in staffing as well; **Max Moulds** retired and has been replaced by **David Britton** (although Max can still be found haunting the collections most days); **Derek Smith** is curating our extensive ant collection, as well as assisting in incorporation of the numerous beetle specimens which have been generated by CBCR survey work. We had to say farewell to **Sally Cowan**, who has decided to swap technical duties for learning to sail in the Whitsunday Islands. Entomology staff and associates have also been busy in the field with Max Moulds collecting cicadas with **Chris Simon's** lab (Connecticut University) in almost every mainland state of Australia, Dave Britton collecting Lepidoptera with CBCR in the Pilbara, WA, **Shane McEvey** collecting Drosophilidae in French Polynesia, and **David McAlpine** collecting Wombat Flies (*Borboroides* spp.) from NSW and ACT. Other changes afoot include the introduction of a new museum-wide database, KE EMu, which will enable further digitisation of the collection. For details see [<www.amonline.net.au/insects/>](http://www.amonline.net.au/insects/).

The Centre for Biodiversity and Conservation Research has been successful in obtaining a Planetary Biodiversity Inventory grant. **Gerry Cassis** (AM) and **Randall Schuh** (American Museum of Natural History) are the co-principal investigators of a global research team, also involving four senior investigators, four postdoctoral fellows, and two PhD students. The project aims to document the global diversity of mirids (some 5000 species), as well as analysing their evolution and association with plants and patterns of biodiversity.

A 5-year partnership with Rio Tinto project is investigating biodiversity patterns in Australia and the Pilbara district of Western Australia. Patterns of biodiversity predicted by national level data are being tested through ecological survey in the Pilbara.

Phase 1 of the FaunaNet bioinformatics program has been completed, resulting in the establishment of the official NSW Master List of Faunal Names (FaunaNames), a world-class webmapping facility (FaunaMap), interactive identification keys (FaunaKeys), a popular education website (Wildlife of Sydney), and other biodiversity information resources. Technology developed through the FaunaNet program is now a platform for a whole-of-government bioinformatics program (BIONET), and was an important factor in the US NSF supporting the PBI project.

The Lord Howe Island Biodiversity and Conservation research program continues with the com-

ment of a project to assess the impact of introduced rodents (rats and mice), using sophisticated fencing to exclude the introduced species. This project is a critical study in NSW as the government and the Lord Howe Island Board are proposing to eradicate the rodents from the island – a major undertaking. Our study will help assess the impact of such an action on the native biodiversity. We are also part of a collaborative project with **Lesley Hughes** (Macquarie University) to assess the impact of climate change on the island.

CBCR, in conjunction with Australian Museum Business Services, is undertaking invertebrate survey work this year as part of a long-term project monitoring biodiversity in the Coleambally Irrigation Area. The project commenced in October 1998 and involves autumn and spring sampling, taken at 5-yearly intervals. The data are also being used for a study analysing the relationship between high water tables/groundwater, salinity levels and burrowing arthropods. CBCR also commenced a 3-year riparian biodiversity monitoring project in the Hunter Valley, allied to the Upper Hunter River Rehabilitation Initiative, investigating the potential for incorporating terrestrial invertebrates as biomonitoring indicators of a riparian habitat restoration project.

Other survey projects in operation include a Long Term Monitoring project of the Sydney region to assess the ongoing issue of prescribed and wild-fires in the Sydney region, with particular reference to urban biodiversity and habitat fragmentation.

Finally, taxonomic work on chrysomelid beetles continues with a revision of the leaf-beetles of Lord Howe Island and a study on kangaroo beetles.

NSW Department of Primary Industries

Orange Agricultural Institute

The City of Orange is located in the Central Tablelands region of New South Wales approximately 250 km west of Sydney. Its high elevation (900 m above sea level), rich basalt soils and reliable rainfall (average 830 mm/year) saw Orange develop as an important deciduous fruit growing area. Apples and cherries grow well in the district. Recent changes brought about by urban encroachment and the decline in the economics of fruit production have seen wine grapes become the dominant horticultural industry, with significant cattle and sheep production.

Entomologists have serviced the Orange district since the mid 1900s. The first appointee provided

research and advisory support across the entire agricultural sector. In 1980, the Department of Agriculture opened a new research facility. It became the base for two entomologists whose work focussed on integrated pest management for the fruit industry. The period 1980 to 1990 saw the successful implementation of a program for the biological control of mite pests in apples.

Orange continued to grow as a centre for agricultural research and development following the relocation of the Department's head office from the centre of Sydney to Orange in 1991. Six years later, the former Biological and Chemical Research Institute in Sydney's west was dispersed to regional parts of New South Wales with the Agricultural Scientific Collections Unit relocated to Orange. The purpose of applied entomology work at Orange is research into the management of deciduous fruit pests in NSW, led by Graham Thwaite, with Anne Hatley and Marion Eslick. There is a general laboratory for laboratory based assessments (mite counts on leaves, thrips and predators on traps, some fruit examinations, occasional diagnostic procedures) data processing, a bioassay laboratory for pesticide related experiments, controlled environment rooms, apple blocks for field trials. Projects have included development of integrated pest and disease management for the apple, prune and stone fruit industries, improved monitoring of codling moth under mating disruption programs in apple, pear and nashi orchards (collaborative with Department of Primary Industries, Victoria), and surveillance of western flower thrips on stone fruit orchards in NSW.

NSW Agricultural Scientific Collections Unit. These collections date from 1890 and include important historical material from WW Froggatt, EH Zeck and AM Lea as well as historical records of the occurrences of insects, mites and plant pathogens associated with agriculture in NSW. There are also extensive original illustrations by EH Zeck (primarily insects) and Margaret Senior (plant diseases and some insects). Because the collections have been amassed primarily through enquiries, the data held within them are of extremely high quality with host records available for nearly 80% of specimens. The collections have statutory protection from the NSW Agricultural Scientific Collections Trust Act which vests ownership of the collections in an independent Trust. The Unit also provides an identification service as well as monitoring for major pest species such as fruit flies (Tephritidae). <<http://www.agric.nsw.gov.au/Hort/>

ascu/index.htm> The staff of the unit include **Murray Fletcher, Andrew Mitchell, Danuta Knihinicki, Peter Gillespie, Birgit Löcker, Merydyn Davison, Matthew Kerr.**

Elizabeth Macarthur Agricultural Institute, Sydney

EMA's Parasitology group, together with CSIRO Livestock Industries and with support from Australian Wool Innovation Pty. Ltd., is working to develop a test to detect sub-clinical infestations of lice on sheep. An ELISA test is up and running but transferring this technology into a rapid test that can be run by producers in the shearing shed is the goal of the next phase of research. The ELISA uses the waxy debris that accumulates on the shearer's comb and cutter. In a trial conducted using artificially infested sheep, samples collected from sheep infested with fewer than 50 lice each returned positive results in the ELISA. **Mozaddedul Haque** is working with **Garry Levot** on the control of *Aethina tumida* (Small Hive Beetle) an exotic parasite of bee hives that was discovered in bee hives in eastern Australia late in 2002. The use of chilling/freezing of stored comb to kill beetles/larvae or arrest beetle development is being investigated. Insecticide bioassays of beetle adults and larvae are being conducted to identify suitable candidates for potential use as soil treatments (to kill larvae) or in-hive treatments to kill adult beetles.

Tamworth Centre for Crop Improvement

Insecticide resistance in cotton pests is a severe limitation to the economic production of cotton in Australia. Cotton pest resistance research is conducted by **Grant Herron** at the Elizabeth Macarthur Institute, at Menangle, near Sydney, by Dr Louise Rossiter at the Australian Cotton Research Institute, Narrabri and by **Robin Gunning** at the Tamworth Agricultural Institute. Insects studied are: various mite and aphid species, *Helicoverpa armigera* and *H. punctigera* and *Bemisia tabaci*. Areas covered in our resistance research are insecticide bioassay, insecticide resistance monitoring, mechanisms, biochemistry and genetics of insecticide resistance and insecticide resistance management.

Yanco Agricultural Institute

Mark Stevens and his group (**Glen Warren, Richard Faulder** and **Michelle Clifton**) are busy writing up their work on *Bacillus thuringiensis israelensis* for chironomid control in rice crops, and are finalising their work on thrips communities

in NSW rice fields, in collaboration with **Peter Gillespie** from Orange Agricultural Institute. Lab work is being focussed on developing a PCR technique for identifying rice tissue in chironomid guts, with assistance from **Peter Hughes** (CSIRO Plant Industry), and on isolating the chemical factors responsible for *Chironomus tepperi* oviposition deterrence by conspecific larval populations. Mark has also been dabbling with the use of herbivore-induced plant volatiles for manipulating populations of beneficial insects in citrus and grapes, spurred on by the success of former Yanco entomologist David James, who is now at Washington State University.

The Entomology group at the National Vegetable Industry Centre, NSW DPI, Yanco includes **Sandra McDougall** and **Jianhua Mo**, with technical assistance from **Andrew Creek, Alan Boulton**, and **Meryl Snudden**. Our focus is in developing IPM systems for vegetable crops. Key projects have been in lettuce, sweet corn, processing tomatoes and onions. For the past 6 years *Helicoverpa* spp. have been the key pests investigated, but more recently thrips and aphids have been worked on. Much of the work has been developing basic IPM systems, evaluating the potential of beneficials in the various systems, evaluating and assisting access to IPM-friendly management options, producing resources to assist growers, and conducting a range of extension exercises to facilitate adoption. Jianhua is currently finishing up his lightbrown apple moth project in citrus (2001-2004) and onion thrips project in bulb onion (2003-2004), both funded by Horticultural Australia. The first project investigated the biology of the insect in citrus, the effectiveness of mating disruption, and new spray options. The thrips project investigated seasonal patterns of thrips species in and around onion fields, and new spray options.

Macquarie University, Sydney, Department of Biological Sciences

The Plant-Insect Interactions and Climate Change Ecology Laboratory includes **Lesley Hughes, Alison Basden** (Research Associate), **Nigel Andrew** (Honorary Associate), **Linda Beaumont** (PhD Student), **Emma Laxton** (PhD student), **Nathalia Velez** (PhD student), **Chris Muller** (PhD student), **Robyn Sinclair** (Masters Student), and **Scott Ginn** (Research Assistant). Our main research interests include insect-plant interactions, effects of climate change on plants and animals, insect herbivory and insect community structure. Current and emerging entomological projects in-

clude: using the relationship between insect community similarity and phylogenetic relatedness of host plants to estimate biodiversity at local, regional and global scales (Hughes); potential impacts of climate change: insect herbivores and herbivory along a latitudinal gradient (Andrew); comparison of the effects of host plant distribution and climate on the distribution of Trapezitinae (Beaumont); a 90-year record of the impact of climate on the range margin of *Tisiphone abeona abeona* and *T. a. albifascia* (Beaumont); effects of resource allocation on insect herbivory and anti-herbivore defenses (Laxton); potential impacts of climate change on the invertebrate biodiversity of Lord Howe Island (Velez); phylogeny of the butterfly genus *Delias* (Muller); the ecology of the leaf mining insects in Australia. (Sinclair); and morphological variation in *Ciulfina* sp. (Mantodea: Mantidae) a multi population analysis (Ginn). See<<http://www.bio.mq.edu.au/ecology/cccg/CCEG.html>>

At the Key Centre for Biodiversity and Bioresources **Andrew Beattie** and **David Briscoe** are asking whether we have been missing something when thinking about how the social insects evolved. We know that specialized genetic and caste systems, the division of labour and care of offspring are involved but maybe there is an even more basic issue. Consider the main attributes of a social insect colony: many individuals living in close proximity, most of them closely related. This should be heaven for pathogenic microorganisms, so we are exploring the idea that the evolution of sociality was accompanied by the evolution of more diverse, specialized, antimicrobial compounds. Our team is led by two Postdoctoral Fellows, **Tish Silberbauer** and **Adam Stow** who, in turn, look after a variety of honours and postgraduate students and volunteers. The basic plan is to compare various antimicrobial attributes in carefully selected solitary, semi-social and eusocial insects, especially those with known phylogenies. We are fortunate in Australia that at least one genus, *Exoneura*, a common native bee, has species that exhibit each of these states. Thus, we are looking at bees and wasps among the Hymenoptera. We are also collaborating with **Mike Schwarz** and **Mike McLeish** (Flinders University) in an investigation of solitary and social Thysanoptera. Wherever possible we are examining the microbial loads on their bodies and in their nest cavities by molecular methods and we assay the antimicrobial compounds each species produces. In every case we also measure the genetic diversity and relatedness of the individuals in each nest or colony. Right now there is some

evidence for the idea but there is a long way to go.

University of New England, Armidale

School of Rural Science & Agriculture. **Peter Gregg**, **Alice Del Socorro**, and two PhD students, **David Britton** and **Sam Lowor** are involved with semiochemical research of Australian cotton pests. Over several years, Peter and Alice have been working on developing attractants for *Helicoverpa* moths, based on plant volatiles. They have been conducting small- and large-scale field trials to determine the impacts of attractants on *Helicoverpa* numbers and oviposition, including effects on other non-target insects. The project is funded through the Australian Cotton Cooperative Research Centre, which has now licensed the commercialisation of an attract-and-kill product called Magnet®, with an Australian company, Ag Biotech Australia Pty Ltd. Magnet® had a limited commercially released during the 2003-2004 cotton season. Ag Biotech is now in the process of registering Magnet® for next season. David's project involved studies on slow-release formulations for *H. armigera* sex pheromones in cotton pest management. He now works as the Entomology Collection Manager in the Australian Museum while finishing his thesis. Sam is investigating the sex pheromones of the several occasional pests in cotton, the rough bollworm (*Earias huegeliana*), the cotton tipworm (*Crocidosema plebejana*) and the green mirid (*Creontiades dilutus*). He has identified the pheromone components of these species which have been shown to catch substantial numbers of conspecific males in field traps.

Another PhD student, **Ingrid Rencken** is studying the role of native vegetation in harbouring generalist predators, movement of generalist predators between cotton and surrounding native vegetation, and reducing insect pest damage in cotton. Her project involves regular suction sampling of windbreaks of native tree species, travelling stock routes, native weeds and grasses around cotton fields in Narrabri, NSW and identification of the generalist predators therein. **John Stanley** is responsible for running the Cotton Production Course offered through UNE and the Universities of Sydney and Queensland (Gatton) under the Cotton CRC's Education Program.

School of Environmental Science and Natural Resource Management, Department of Zoology. **Sydney Lee Jordan** is a PhD student investigating whether burrowing behaviour is useful in higher level phylogeny reconstruction in Mygalomorphae. She is supervised by **Mary Notestine** (University

of New England) and **Robert Raven** (Queensland Museum). The majority of mygalomorph spiders (trapdoors, tarantulas, funnel webs) lead sedentary lives in burrows they have excavated in the soil. The burrowing behaviour of these spiders is being investigated to determine if it will provide useful characters for understanding the phylogenetic relationships within this group. Burrowing behaviour is recorded in the laboratory and the burrowing behaviour of each species is described in detail. From this, behavioural characters will be determined and used in a cladistic analysis. The burrow structure and related morphology will also be investigated and the results compared to the currently accepted phylogeny for this group. Sydney is always searching for specimens, so please contact: <sjordan2@pobox.une.edu.au>.

University of New South Wales

Centre for Entomological Research and Insecticide Technology

CERIT was established in 1986. It is an Industry Linkage Centre of the University providing research and development, consulting and training services in insect pest management, focused on safe and effective management in urban and commercial environments. CERIT entomologists regard insecticides as valuable resources rather than disposable products, and projects aim to maintain the value of these resources by using them safely, intelligently and with maximum effectiveness within an IPM framework.

Specific research areas include: new strategies for insect control; testing methodology for insecticides and other means of insect control; modes of action and resistance mechanisms of insect control chemicals; insecticide delivery systems - aerosols, vaporisers, surface treatments, fumigants, baits, etc; insect repellents, expellents and oviposition suppressants; pest management audit methods; methodologies for efficacy-screening potential insect control chemicals; and insect culturing methodology.

CERIT offers a range of research, testing, consultancy, information provision, and training services to industry, focusing on managing insect infestations and initiating, developing, testing or registering insect control products and extending insect management information to appropriate industries. <www.unsw.edu.au/unisearch/cerit>

Australian Defence Force Academy, Canberra

Special-purpose radar units have been developed by **Alistair Drake** and **S Hatty** (School of Physi-

cal, Environmental and Mathematical Sciences) for observing insect migratory flight. These detect individual insects passing overhead at altitudes between 200 and 1400 m, and determine the insects' sizes, the speeds and directions in which they are moving, their heading directions, the frequencies and intensities of their wingbeats, and two measures of their shape. The machines operate automatically, so that observations can be made over long periods at low costs. Two units are installed in the inland of eastern Australia and are operated remotely from our Canberra laboratory; summaries of their results can be downloaded each morning via a telephone link. A third unit is mounted on a trailer and is used for occasional short-term observing campaigns at other locations. The insects detected are mainly moths of a variety of species (several of which are important agricultural pests), and Australian plague locusts. Current research is focused on using the data in pest-management decision support, and is being undertaken in collaboration with the Australian Plague Locust Commission. Other research objectives include: characterization of insect migration systems in the unpredictably variable semi-arid environments of inland Australia; elucidation of the relationship of migration to atmospheric structure, weather processes, and climate variability; and the development of novel methods for identifying and quantifying insect migration.

University of Sydney

Department of Medical Entomology, & Institute of Clinical Pathology and Medical Research, Westmead Hospital, Sydney

Staff of this department include **Richard C. Russell**, **Stephen L. Doggett**, **Merilyn J. Geary**, **John G. Clancy**, **John Haniotis**, **Cameron E. Webb**, **Karen J. Willems**, and PhD student **Petrina H. Johnson**. In its university role the department undertakes teaching and research (particularly for postgraduate students), while providing pathology and consultative services from the ICPMR to federal, state and local government authorities, private industry and the general public through its accredited role of state and national reference laboratory. Recent research activities have concentrated on evaluating the competence of mosquito species for transmission of arboviruses such as Ross River virus and Barmah Forest virus, and investigating the ecology of saline and freshwater pest and vector mosquitoes in relation to wetlands conservation, rehabilitation and construction. The members of the Department are involved in

routine surveillance and outbreak investigation of vector and pathogen activity (particularly mosquitoes and arboviruses), investigation of public health pests and their management (e.g. mites and bed bugs) and providing risk assessments for community development proposals (e.g. mosquito impacts on industrial and residential sites), testing of vector control agents and devices, culture of mosquitoes (various genera and species) and other diptera (e.g. *Musca* and *Lucilia* spp.) for insecticide and repellency testing, and provision of disinfected maggots for clinical wound management to state, national and international health facilities.

The Department has established two comprehensive websites, one for general medical entomology (www.medent.usyd.edu.au) and the other more specifically for mosquito and arbovirus surveillance (www.arbovirus.health.nsw.gov.au), that provide extensive information, both written and photographic, on a range of issues related to medical and public health entomology in Australia.

Faculty of Agriculture

There is an active project managed by **Alan Clift** and **Harley Rose** on vector thrips and tospoviruses, in collaboration with NSW Agriculture. The work is field based, examining factors influencing vector thrips numbers and tospovirus transmission. The vector thrips are onion thrips, *Thrips tabaci*, tomato thrips, *Frankliniella schultzei* and western flower thrips, *F. occidentalis*. Our main focus is tomato spotted wilt virus, but we also monitor iris yellow spot virus (not widespread). A range of areas are monitored as part of the project, including Sydney Basin (market gardens), Murrumbidgee Irrigation Area (lettuce, tomatoes and potatoes) and Crookwell-Robertson area (seed and table potatoes). At least two vector species are usually present in each area. In the Sydney Basin it is usually *T. tabaci* and *F. occidentalis*, in the other areas it is *T. tabaci* and *F. schultzei*.

In the Sydney Basin, *T. tabaci* will often vector TSWV onto properties formerly free of the disease. If *F. occidentalis* is present, even in low numbers, the incidence of TSWV infection can exceed 80% within a few generations. In the other areas, either vector species can infect plants, but *F. schultzei* is the more efficient vector. While *F. occidentalis* is generally regarded as the most efficient vector, the Australian experience is both species of *Frankliniella* are equally efficient in transmitting TSWV when infective, but *F. occidentalis* is more likely to be infective.

Harley Rose is supervising a PhD project on the

biochemical basis of insecticide resistance in western flower thrips, *Frankliniella occidentalis*. The PhD student, **T Swaminathan**, is presently determining the resistance levels in selected strains of the thrips in collaboration with **Grant Herron**, Elizabeth Macarthur Agricultural Institute, NSW Department of Primary Industries and **Robin Gunning**, Tamworth Agricultural Research Centre, NSW DPI. Resistance mechanisms to be investigated include esterases, glutathione-S-transferases and multi-function oxidases. The role of synergists, especially piperonyl butoxide, will also be examined.

We also have a major project investigating the Australian native weevil, *Orthorhinus cylindrirostris*, as an important pest of blueberry plantings on the mid north coast of New South Wales. The larvae tunnel in the stems and crown of the bushes, reducing the productive life of bushes from >15 years to <10 years, often as short as 7 years. The adult weevil can be up to 20 mm in length and the exit holes are at least 8 mm in diameter. There are major varietal differences in susceptibility to the weevil. The requirement for bees to pollinate flowers for optimal fruit set, and variation in flowering time between varieties, restricts conventional pesticide use. The weevil larvae are protected from insecticide application by more than 1 cm of living wood. The use of pathogenic fungi, such as *Beauveria bassiana*, is being investigated as one option to reduce weevil adult and larval numbers and, if successful, will be included in an area-wide management program for this pest.

Orange Campus, Faculty of Rural Management, Pest Biology and Management Group

Our location in rural NSW enables us to conduct applied research leading to better management that is underpinned by sound biological understanding. The group consists of **Geoff Gurr**, **Anantanarayanan Raman**, **Aaron Simmons**, **Birgit Loecker**, **Holger Loecker**, **Mahmuda Begum**, **David Chang**, **Ronald Bonafacio**, **Julie Bodan**, **Steve Wratten** (Visiting Prof). Projects include: management of lucerne yellows and its leafhopper vectors, habitat manipulation for vineyards pests, arthropod resistance in tomatoes and its compatibility with biological control, hypersensitive responses of grapevine to phylloxera aphid, pest suppression, wildlife value of floristically diverse shelterbelts, silk production by *Kahaono montana*, and taxonomy of the Australian Cixiidae. Recent major publications from the group include *Ecological Engineering for Pest Management: Advances in Habitat Manipulation for Arthropods*

(CSIRO Publishing) and *Biology, Ecology, and Evolution of Gall-inducing Arthropods* (Science Press). See <<http://www.orange.usyd.edu.au>>

School of Biological Sciences, University of Wollongong

Entomology at the University of Wollongong is based around two laboratories, those of **James Wallman** and **Kris French**. In the Wallman lab research focuses on topics concerned with the systematics and biology of flies, and forensic entomology. The major current projects are: systematics of Australian calliphoridae using morphological and molecular techniques to understand the evolutionary relationships of Australian blowflies; application of the ITS and other gene regions to the identification of blowflies of forensic importance in collaboration with **Mark Dowton** and **Leigh Nelson**, also from Biological Sciences; and developmental studies on blowflies of forensic importance by **Donnah Day**. The Australian Research Council, the New South Wales Police and the South Australia Police currently help fund James Wallman's laboratory.

The terrestrial ecology group run by Kris French is undertaking a number of projects that investigate the response of invertebrate communities to disturbance. The work centres on two habitats: weed invaded habitat and urban communities. Work in weeds is investigating whether current herbicides have impacts on non-target invertebrates. Work in urban habitats investigates whether the exotic species that we plant in our gardens provide a diverse and abundant insect fauna. This may help explain the paucity of insectivorous birds in these communities. The group is also finalising some work investigating the spatial and temporal variation in dipteran communities in eucalypt forests. This work will be the first of its kind investigating temporal and spatial variation amongst different families of flies.

NORTHERN TERRITORY

CSIRO Sustainable Ecosystems

Tropical Ecosystems Research Centre Darwin

Long-term landscape health can only be achieved if the basic ecosystem functions of capturing and recycling water, nutrients and carbon are maintained. **Tracy Dawes-Gromadzki's** research focuses on the critical roles that soil macrofauna (and particularly termites) play in these key processes. Current research areas include (1) The functional roles of soil macrofauna in nutrient cy-

cling and eco-hydrology; (2) The impacts of land management practices (cattle grazing, fire, mining) on soil macrofauna function and the consequences for soil and landscape health; (3) The application of stable isotope analyses to further understand landscape functioning, through quantification of the trophic positions and dietary preferences of soil macrofauna, and landscape processes (e.g. water use efficiencies of vegetation, nitrogen dynamics, turnover rates); (4) Identification of key soil macrofauna and landscape elements (e.g. tree patches, log mounds) critical for sustainable production and biodiversity, and (5) The application of termites as a management tool to kick-start the restoration of soil function in degraded landscapes.

Kate Parr and **Alan Andersen** have begun working on a new Bushfires CRC funded fire experiment at the Territory Wildlife Park, just outside Darwin. The principle aim is to investigate the effects of fire on invertebrates (focussing primarily on ants), and includes the following key areas: (1) Effect of fire frequency and time-since-fire on invertebrate diversity and community structuring; (2) Effect of single fire events vs. fire regimes on invertebrate diversity and community structuring; and (3) Improving our understanding of the mechanisms responsible for invertebrate responses to fire.

Ben Hoffmann's research focuses on exotic pest ant eradications throughout northern Australia. The largest project (conducted in collaboration with Dhimurru Land Management Aboriginal Corporation, and other Indigenous land management groups) is the eradication of the Yellow crazy ant, *Anoplolepis gracilipes*, from northeastern Arnhem Land. Ben is also initiating an eradication programme for African big-headed ant (*Pheidole megacephala*) and Tropical Fire Ant (*Solenopsis geminata*), and a management programme for Singapore ant (*Monomorium destructor*) throughout the Tiwi Islands, north of Darwin. With Alan Andersen, research is also continuing on the use of ants as bio-indicators, with a particular focus on minesite rehabilitation.

Department of Infrastructure, Planning and Environment, Parks and Wildlife Service

Colin Wilson has been working with an Aboriginal community group to protect an endangered butterfly in remote north eastern Arnhem Land. The Gove crow butterfly, *Euploea alcatheae enastri*, has been found only in four tiny patches of monsoon rainforest on the Gove Peninsula. These habitats are directly threatened by invasions of yellow crazy ants (*Anoplolepis gracilipes*), Mission grass

and Asian water buffaloes. Colin has also been conducting surveys for one of Australia's most spectacular insects, Leichhardt's grasshopper (*Petasida ephippigera*), on remote sandstone outcrops in the Top End of the Northern Territory. Previously considered extremely rare, many new populations and several new host plants have been discovered, leading to the conclusion that these insects are actually not uncommon if you look in the right places at the right time of year.

Following requests from pet dealers who wish to sell exotic tarantulas and scorpions, Colin has encouraged a captive breeding operation using locally captured native species. This should supply the increasing demand for these bizarre pets and save vulnerable wild populations of these long-lived creatures from poachers.

Australian Quarantine Inspection Service

The brief of the Northern Australia Quarantine Strategy is to provide early warning of exotic organisms that may have breached our quarantine barrier. The focus is on remote areas that are not well serviced by other organizations, such as agriculture departments, CSIRO or universities, and which are vulnerable to incursions from natural spread on wind and sea currents, and illegal human activity involving fishing vessels and asylum seeking boats. NAQS has three entomologists, **Judy Grimshaw** in Queensland, **Tony Postle** in Western Australia, and **Glenn Bellis** in Northern Territory. From Darwin, Glenn Bellis must survey the entire coastline of NT on average every 2-3 years, and also supervise a fruit fly trapping program in remote coastal NT.

Aboriginal communities own nearly all of NT coastline, and a significant part of NAQS work is increasing quarantine awareness. The training of aboriginal ranger groups in collecting insects has recently begun, in the hope that they will include such activities in their role of protecting their country.

NAQS also carries out significant amounts of work in neighbouring countries, especially East Timor, assisting locals to conduct surveys to assess the status of pest in their country, and capacity building, in pest collection, curation and identification.

Glenn Bellis is also the reference entomologist for the National Arbovirus Monitoring Program, identifying biting midges collected in a network of light traps throughout NT.

Dept of Health – Medical Entomology Branch

This organization, with a staff of eight, provides

advice and carries out surveillance and control of insects that affect human health throughout NT. Mosquitoes and biting midges are the primary focus.

Activities include entomological surveillance and investigations to prevent malaria, dengue and other exotic mosquito borne diseases, an endemic arbovirus disease surveillance and investigation service using sentinel chickens and virus isolation from mosquitoes, mosquito monitoring and control operations in major population centres, cooperative and applied research on insects of medical importance, and promoting public awareness and providing an advisory service on insects of medical importance.

Recent activities have been the detection of the exotic mosquito *Aedes aegypti* in Tennant Creek, a cooperative program with AQIS eliminating *Aedes albopictus* in the port area of Darwin, routine large scale aerial control of salt marsh mosquitoes in Darwin, and *ad hoc* aerial control in Katherine after flooding and in Alice Springs during Murray Valley encephalitis risk periods.

Northern Territory Dept of Business, Industry and Resource Development; Entomology

Seven staff members of Entomology Section, **Brian Thistleton**, **Graham Brown**, **Deanna Chin**, **Michael Neal**, **Haidee Brown**, **Lanni Zhang** and **Heather Wallace**, are based at Berrimah Farm in Darwin, and **Megan Hoskins** is based at Katherine Research Station. **Stuart Smith**, formerly Principal Entomologist is currently the manager of the Plant Health Branch. Besides managing the Branch and providing legislative requirements on plant health issues, Stuart is involved with a pilot project using steriles to suppress Queensland fruit fly in Central Australia.

The Section provides a range of entomological services to growers, government departments, householders, home gardeners, and the general public. These services include specimen identification and advice on crop monitoring and integrated pest management. The Section conducts surveys for detection of exotic pests and provides information on pest distribution and management of exotic incursions.

Current research projects for the Section includes studies on integrated pest management in tropical fruit, vegetables, nursery stock and agroforestry; and the biology and control of termite pests of fruit trees and agroforestry. Staff provide curation and management of the Northern Territory Economic Insect Reference Collection as well as research

on the taxonomy of economic pests.

QUEENSLAND

Queensland Museum

The State Museum for Queensland is situated in South Brisbane at the corner of Grey and Melbourne Streets, only a couple of hundred yards from the meeting venue for ICE2004. The museum has three floors of exhibitions on natural and cultural history of Queensland, including many aspects of entomology. In addition, a small special display on Queensland insects will be mounted in the entrance foyer to welcome delegates to ICE. We hope delegates will find time to visit, opening hours being 9.30 to 5.00 daily, and entry is free. A cafeteria for coffee or meals is on the lower exhibition gallery floor.

The Museum was founded in 1862 but development of the insect collections did not start in earnest until 1911 when Henry Hacker was appointed the first full-time curator of insects. He was a prodigious collector with special interests in Hemiptera and Hymenoptera. After Hacker's retirement in 1943, the Museum was without an entomologist for many years, though retired lepidopterist Alfred Jefferis Turner spent much time working on the important moth collection formed by Wilfrid Barnard. In 1962, **Ted Dahms** was appointed, being the first university trained insect curator. He worked with Hymenoptera (Encyrtidae) and spent much time cataloguing the 3500 confused type specimens of erratic chalcid worker, AA Girault, whose collection had been progressively lodged at the Museum during his working years in the 1920s and 30s. In 1978, **Geoff Monteith** moved from the University of Queensland Insect collection to become the second insect curator at the Museum. He has interests in the Hemiptera (especially the Aradidae) and Coleoptera (especially the dung beetles) and has done systematic collecting of rainforest insects throughout Queensland. Following the departure of Ted Dahms in 1993, his position was temporarily taken by **Kevin Lambkin** (who worked with Neuroptera and Mecoptera), before **Chris Burwell** was appointed to the position in 1995. His interests are with Hymenoptera (especially the Eulophidae and Formicidae) and he has a long term interest in the insect diet of insectivorous bats. Honoraries who regularly work with the collections are **Rudy Kohout** (ants of the genus *Polyrhachis*), **Tony Ewart** (cicadas) and **John Lawrence** (Coleoptera).

Currently Geoff Monteith and Chris Burwell share



Gondwanan stag beetle - *Sphaenognathus*

the curating of the insects, and they are ably assisted, respectively by **Geoff Thompson** (who is an award-winning insect illustrator), **Susan Wright** (who has a research interest in hover flies), **Karin Koch** (who keeps the databases on the straight and narrow) and **Doug Cook** (who helps with field work and specimen processing). Recent projects include: mapping and databasing of dung beetles, drawing upon the 65,000 specimens in the Museum collection; a pilot insect survey of bushland reserves in Brisbane which yielded 253 species of ants alone; surveying of conservation reserves in New Caledonia, from which place the Museum now holds substantial insect collections; describing (with **Barry Moore**) a new species of the gondwanan stag beetle genus *Sphaenognathus* from Queensland.

Dept of Primary Industries and Fisheries

Food Protection Team

Pat Collins, with **Greg Daglish** and **Manoj Nayak** provide research, development and extension services to increase profitability in the grains value chain, through biological studies and development of management strategies for grain storage. These objectives are met using a range of specialist facilities, including laboratories designed for insect culturing, insecticide testing, fumigation testing, pesticide resistance testing, insect identification, studies of insect biology, also controlled environment rooms catering for insect cultures with a wide range of reference insect strains, insect rearing facilities, and an AQIS approved quarantine facility.

Northwatch

This is an animal and plant pest surveillance and response program in North Queensland, an area particularly at risk due to proximity to South East Asia and Papua New Guinea, and close collaboration is maintained with AQIS. Activities include: surveillance for exotic pests on Cape York Peninsula and in urban centres south to Mackay; male attractant trapping for exotic fruit flies on the mainland, screw worm fly (*Chrysomya bezziana*) surveillance on Cape York Peninsula; monitoring for Asian honeybee (*Apis cerana*) and associated mites; promoting community assisted surveillance. Detections and responses made in recent years includes mango leafhopper (*Dioscopus nitidulus* and *I. clypealis*); red banded mango caterpillar (*Deanolis sublimbalis*), spiralling whitefly (*Aleurodicus dispersus*) and crazy ant (*Anoplolepis gracilipes*).

Fruit Fly Control/Market Access Research

A team of researchers in Horticulture and Forestry Sciences in DPI combines entomological skills with plant biosecurity expertise to deliver the complete fruit fly control/market access package to horticultural industries. Led by **Annice Lloyd**, with **Pauline Wyatt**, **Ed Hamacek**, **Peter Leach**, **Liz Hall** and **Rod Jordan**, plus biometrician **Rosemary Kopittke**, physiologist **John Cavallaro** and technical staff (**Chris Neale**, **Marianne Eelkema**, **Thelma Peek**, and **Dawn Scannella**), the combined experience of the team covers fruit fly biology and taxonomy, preharvest control, postharvest disinfestation, technology innovation, fruit quality assessment, market access biometry, and phytosanitary protocol development. Based at Indooroopilly in Brisbane and at Cairns in north Queensland, team members address fruit fly is-

ssues for both tropical and subtropical horticultural industries.

Two current projects are focussed on citrus production in the Central Burnett. An area-wide fruit fly management project, known locally as the Fruit Fly Force, involves close collaboration with industry, consultants, local government and town communities in the area. This is the first time that such a program has been attempted in a fruit fly endemic area in Australia. In a second citrus project, the market access team is expanding its expertise to include non-entomological quarantine issues. In collaboration with DPI&F plant pathologists, the team is developing a field management system for the fungal disease, citrus black spot. The outcomes from both of these projects will be used as components in a quarantine submission aimed at gaining access for Central Burnett citrus to lucrative US markets.

Entomology at Toowoomba

David Murray, **Melina Miles** and **Austin McLennan** are investigating area-wide management of *Helicoverpa* spp. There is a strong extension component to this work with regular assistance given to management or grower IPM groups in southern Queensland. We also contribute to other training activities such as the Cotton IPM short course for growers, and the pulse industry's Chickpea and Mungbean agronomist accreditation courses. This is in addition to our own extension activities such as the production of regular newsletters and hands-on workshops held this summer looking at how to monitor and make use of *Trichogramma* to reduce insecticide use.

Brad Scholz and **Nathaniel Parker** are developing sustainable pest management practices for cotton farming systems on the Darling Downs. In particular they have focussed on incorporating *Trichogramma* egg parasitoids into *Helicoverpa* integrated pest management programs. **Amanda Cleary** is a PhD student investigating the effect of crop stubble on *Helicoverpa* and its natural enemies.

Adam Hardy and **Lawrence Smith** are looking to locate and clone the gene(s) in sorghum associated with antibiosis resistance to sorghum midge. A useful product of this work would be molecular markers for midge-resistance genes in sorghum.

Bernie Franzmann and **Lawrence Smith** have just completed work on the biological control of aphids in cotton. Their work documents the important natural enemies in cotton and their alternative aphid/crop/weed hosts and the alternative hosts of cotton aphids.

Centre for Tropical Agriculture, Mareeba

Mareeba is on the Atherton Tableland west of Cairns in far north Queensland, an area of diverse agriculture; beef cattle, dairying, pasture seed production, sugarcane, maize, peanuts, potatoes, sweet potatoes, tea-tree, tea, coffee, lychees, longans, macadamias, cashews, avocados, papaya, bananas, mangoes and a range of minor crops. It was previously the largest tobacco-growing district in Australia. The area boasts 3 research stations, all within a 30-minute drive of Mareeba. Entomological research is focussed on pest management in horticultural crops, and while the main emphasis is on tropical tree fruits, vegetable projects are occasionally undertaken.

The CTA is home to two entomologists (**Harry Fay** and **Bruno Pinese**) and three technical staff (**Ross Storey**, **Keith Halfpapp** and **Rob Bauer**). It is also home to one of the largest entomological collections in northern Australia, with a particular emphasis on the Coleoptera. Current and recent research projects include the development of a baiting system for fruitpiercing moths, procuring a new male lure for a non-lure responding *Bactrocera* species, refining pest management strategies for two-spotted mite and fruitspotting bugs (*Amblypelta* spp.) in papaya, establishing sampling and decision-making methods for soil insect pests of potatoes, assessing pest management options for sweet potato weevil, examining the biology and control of mango scale, exploring fruit fly control options in mangoes and studying the biology and management of red-banded mango caterpillar (*Deanolis sublimbalis*) in Papua New Guinea.

Maroochy Research Station, Nambour

Entomological capability at Maroochy rests with three entomologists: **Dan Smith**, **Geoff Waite** and **Chris Freebairn**. All are involved in the development of IPM systems for subtropical fruit crops, with an emphasis on biological control and other non-chemical methods. Their efforts have resulted in the widespread commercial adoption of the pest management systems they have developed, and that are among the most successful of their type in the world.

Dan Smith arrived at Maroochy in 1968, and has spent most of his time conducting research on citrus pests, developing and maintaining an IPM system for the crop in Queensland. This system has now been operating for 30 years, with annual pesticide savings of \$5 million. Classical biocontrol, particularly of scales and mealybugs, has been a favourite issue, with successful introduction of

over 30 exotic beneficials for the control of pests in citrus, papaws, custard apples and passionfruit. Dan was awarded the Graham Gregory Medal by HRDC, for excellence in horticultural research, notably in citrus, for developing sustainable IPM.

Geoff Waite worked on lucerne, soybeans, sunflowers and cotton for 11 years, at Toowoomba and Emerald, before moving to Nambour in 1980, to work on subtropical horticultural crops. Geoff has developed a very successful IPM system for field-grown strawberries, based on the biological control of *Tetranychus urticae* by *Phytoseiulus persimilis*. This system uses the 'pest in first' and 'simultaneous release' strategies to establish the mite predators in the crop early in the season. Control of other pests is through increased tolerance of their presence by growers, and the minimal use of non-disruptive chemicals.

Chris Freebairn, after postgraduate research on a mermithid nematode parasite of mosquito larvae, worked for Ecogen Australia and QDPI at MRS Nambour on commercialisation of a bait-based system using insect parasitic nematodes for control of banana weevil borer. For the 10 years since then he has worked with Dan Smith on citrus IPM. Chris has worked on a range of pests including citrus leaf-eating weevil (*Eutinophaea bicristata*), red scale (*Aonidiella aurantii*), and citrus leafhopper (*Empoasca smithi*), and is currently working on the recently arrived South African citrus thrips (*Scirtothrips aurantii*), and the phytoseiid predatory mite, *Euseius victoriensis*. Chris is also a highly skilled insect & mite photographer, with over 800 images published in books, field guides, saleable CDs and posters, most notably in the book *Citrus pests and their natural enemies; Integrated Pest Management in Australia*.

Apples at Stanthorpe

Frank Page and **Peter Nimmo** have completed a successful demonstration trial in a grower's apple orchard at Stanthorpe as part of a Horticulture Australia project. Two applications of spinosad adequately controlled western flower thrips, *Frankliniella occidentalis*. "Pansy-spot" damage to the Granny Smith variety was one percent. Collaborative research into control of thrips and codling moth was conducted as part of an organic and low input apple production project which was funded by Horticulture Australia. During a wet summer, satisfactory control of codling moth was achieved in an organic block of apples by using mating disruption alone. In collaboration with **Phillipa Gerard**, Biosecurity, New Zealand, a survey of

the parasitoids of painted apple moth *Teia anartoides* at Stanthorpe has continued. As in the previous year, the main parasitoid was *Hyposoter bombycivorum*. Other incidental minor pests on apples were brown looper *Pholodes sinistrana*, cluster caterpillar *Spodoptera litura* and the antherid, *Anthela varia*.

Kingaroy

With the increasing adoption of transgenic cotton and IPM, the use of broad spectrum chemicals has been reduced against *Helicoverpa*, these incidentally killing mirids and stinkbugs. As a result mirids, *Creontiades* spp. and stinkbugs, *Nezara viridula* (green vegetable bug), have emerged as important pests in Bollgard II cotton. Studies by **Moazzem Khan** are improving understanding of damage potential of these pests, developing phenology based thresholds, and developing management options that are compatible with the existing IPM systems in cotton. The IPM options being tried include parasitoids (*Trichopoda giacomellii*) of green vegetable bugs, trap crops and soft (less disruptive to beneficial arthropods) chemicals.

Stahmann Farms

These pecan nut farms are in northern NSW and Southern Queensland, where **Andrew Ward** is studying a suite of pests. Funded by Horticulture Australia and Stahmann Farms, the research is examining biological and cultural methods to control borers (*Agrianome spinicollis*). Other insects being examined include a stem girdler (*Maroga melanostigmata*) and green vegetable bug (*Nezara viridula*).

Forest Entomology

Research into the pests and diseases of eucalypt plantations and forest health surveillance for Queensland's hardwood plantation estate is conducted by **Simon Lawson** with **Geoff Pegg** (pathologist), **Rebeccah Aigner** and **Janet McDonald**. Research has concentrated on management of key pests, such as eucalypt stem borers (giant wood moths and longicorn beetles), chrysomelid leaf beetles and emerging new pests, such as the spotted gum eriophyoid mite, *Rhombacus* sp. Surveillance has recently detected a number of new pests including a psyllid, *Creiis* sp., on Dunn's white gum. **Michael Ramsden**, **Manon Griffiths**, and **Murdoch De Baar** have established a pilot insect trapping program in the exotic pine estate to survey and identify insects with potential to cause damage, and to provide early detection of exotic incursions.

Judy King and **Manon Griffiths** are investigating chemical control options for homeowners to use in controlling the lantana bug, *Aconophora compressa*. This membracid bug was introduced from Mexico and released as a biological control agent against lantana. It established on lantana, but also on fiddlewood, *Citharexylum spinosum*, and other non-target plant species on which it causes extensive damage. Judy has been trapping and collecting ants in an area of western Queensland stretching from Chesterton Range National Park in the west to Surat in the east, as part of a Land and Water Australia funded project: Ecological thresholds for vegetation management in southern Queensland. More than 30,000 specimens have been collected from 20 patches of poplar box, *Eucalyptus populnea*.

Ross Wylie and **Manon Griffiths** are part of an international team looking at management of shoot damage by the tip moth, *Hypsipyla robusta*, in the domestication of Meliaceae. The Meliaceae contain a number of high value timber trees, including Australian red cedar, *Toona ciliata*, and the cedars and mahoganies of Asia, Africa and America. Throughout their range these trees are attacked by *Hypsipyla* shoot borers. Damage from these insects has made it virtually impossible to establish commercial plantations of these valuable trees. Following a series of genetic resource trials, established and monitored in Australia and the south east Asia region, individual trees showing apparent resistance are being further investigated. Silvicultural options for managing this pest are being examined.

Brenton Peters and **Chris Fitzgerald** undertake research into the efficacy of timber preservatives against damage by insect borers and subterranean termites. Physical barriers, bait toxicants and novel monitoring devices are 'road-tested' in the field. Brenton Peters and **Jock Kennedy** recommend, supervise and implement action on entomological problems where there is regulatory responsibility. This involves implementing the West Indian Drywood Termite program against *Cryptotermes brevis*, and providing technical information, advice and recommendations against lyctine (powderpost) beetles.

Bureau of Sugar Experiment Stations

The braconid wasp (*Cotesia flavipes*) is an active parasitoid of gramineous stalk borers worldwide. **Peter Allsopp** and **Mohamed Sallam** have collected samples from several countries around the world with help from overseas colleagues. **Kate**

Muirhead has started her PhD program at the University of Adelaide, working with **Andy Austin** and **Steve Donnellan** and studying the morphological and molecular differences between populations of this parasitoid from America, Asia and Africa and the native Australian species that attacks larvae of the large moth borer (*Bathytricha truncata*) in sugar cane and other crops.

Bugs for Bugs

Bugs for Bugs is the largest commercial insectary in Australia. The company was incorporated in 1983 and has continued to grow. We currently mass-rear six species of beneficial insects: *Aphytis lingnanensis*; *Cryptolaemus montrouzieri*; *Chilocorus circumdatus*; *Chilocorus baileyi*; *Mallada signata*; *Trichogramma carverae*; and *Trichogramma pretiosum*. As hosts for the beneficial insects we also rear *Aspidiotus nerii*, *Planococcus citri* and *Sitotroga cerealella*.

Bugs for Bugs began by servicing the citrus industry in the Central Burnett District, in Queensland. The company now supplies insects to a wide range of industries, including grapes, tomatoes, cotton, passionfruit, greenhouse crops and nurseries. Insects are sent to almost all parts of Australia, and *Cryptolaemus montrouzieri* is exported to Europe. We are in the process of developing a fly-parasite rearing project, in collaboration with the Queensland Department of Primary Industries and Forestry. The project is aimed at improving control of nuisance flies in intensive animal husbandry and around feedlots.

The second edition of the popular *Best Friends Natural Enemies*, providing an introduction into the use of Integrated Pest Management, has recently been produced by Bugs for Bugs. This will soon be available on DVD, and updates and expands on the first edition video released in 1989. The focus is on IPM in citrus, but the same principles apply in other crops. IPM in citrus demonstrates a successful, co-ordinated approach between researchers, growers and private industry. The result has been a reduction of pesticide usage, with no loss of fruit quality. The DVD shows the various components of IPM, including: classical biological control; mass rearing and release of beneficial insects; monitoring for pest and beneficial species; and cultural practices. Reference is also made to the history of IPM establishment in Queensland, especially in the Central Burnett District, and to some early successes of classical biological control.

<www.bugsforbugs.com.au>

USDA/CSIRO Australian Biological Control Lab.

Research programs at this lab focus on exploration for biological control agents for plants and insects that are native to Australia and/or Southeast Asia but are invasive in the USA. Two of the weed targets are the broad-leaved paperbark tree, *Melaleuca quinquenervia*, and Old World climbing fern, *Lygodium microphyllum* both of which are native to Australia and invasive in the Florida Everglades. ABCL is staffed by **John Goolsby** (USDA-ARS), **Matthew Purcell**, **Tony Wright**, **Jeff Makinson**, **Bradley Brown** and **Ryan Zonneveld** (CSIRO Entomology)

Two agents have been released for *M. quinquenervia* at the Invasive Plant Research Laboratory, Ft. Lauderdale, Florida, and are having a significant impact on the invasive tree throughout its invasive range. Release of a third agent, the gall making fly, *Fergusonina turneri* and its mutualist nematode, *Fergusobia quinquenerviae* is planned for the late 2004. Preliminary host-range and phenology studies of the stem-galling cecid, *Lophodiplosis trifida*, were completed and this insect was exported to the US for final quarantine screening. Current field and laboratory research in Australia is focused on the flower-feeding weevil, *Haplonyx multicolor*, and the puff gall, *Sphaerococcus ferrugineus*.

Foreign exploration for the *Lygodium microphyllum* biological control program focused on finding the origin of the invasive Florida genotype in the native range; host testing of the eriophyid mite, *Floracarus perrepae*; and development of rearing methods for the *Lygodium* stem-borer, *Ambia* sp. Collections of *L. microphyllum* from across its distribution were compared using molecular diagnostics. The population from the Iron Range in Cape York was found to be a match for the invasive population. This discovery led us to a population of *F. perrepae* that readily feeds and develops on the Florida genotype of *L. microphyllum*. Full host-range testing of *F. perrepae* was completed and a petition for release was submitted in February 2003. Progress was made in developing an artificial diet for the stem-borer, *Ambia* sp. from *L. flexuosum*, but this insect failed to rear on *L. microphyllum*. Plans are underway to find populations of a rarer, second species of *Ambia*, which feeds exclusively on *L. microphyllum*.

Exploration was conducted in the Northern Territory of Australia for natural enemies of the pigeon pea podfly, *Melanagromyza obtusa*, a new exotic pest of pigeon peas in the Caribbean. The podfly was recovered from the native pigeon pea,

Cajanus latispelus along with two parasitoid species. Natural enemies have been sent to cooperators in the Dominican Republic and Puerto Rico for quarantine screening.

University of Queensland

Research into molecular host-parasitoid interactions is led by **Sassan Asgari** and is focused on insect host-parasitoid immune interactions, insect immunity, molecular biology of insect viruses associated with parasitoid wasps (polydnaviruses and ascoviruses). Most insect parasitoids use maternal protein secretions to manipulate host physiology, allowing the developing parasitoid to utilize the host as a food source. These maternal secretions are produced in various ovarian tissues, such as calyx tissues and accessory glands. Interestingly, secretion fluids of certain parasitoids contain viruses called polydnaviruses or virus-like particles, which are produced inside ovarian cells and released into the oviduct to be injected into the host together with the egg. The primary function of polydnaviruses appears to be immunosuppression of the host encapsulation response. Ascoviruses are another group of insect viruses transmitted by parasitoid wasps that cause a fatal disease in lepidopteran larvae. We are interested in researching viruses and maternal secretions associated with parasitoid wasps to explore their function in host-parasitoid interactions and insect immunity.

Griffith University, International Centre for Management of Pest Fruit Flies

The Queensland-based fruit fly research program has a long and rich heritage. Now based at Griffith University in Brisbane, under the leadership of **Dick Drew**, it has recently been incorporated into the ICMPFF. The Centre has the unique privilege of partnership with all ten ASEAN countries - Brunei, Indonesia, Laos, Malaysia, Yarmal, Philippines, Singapore, Thailand, Vietnam - united to answer the urgent threat of a pest that oppresses the region's efforts to achieve food security, reduce poverty and develop international trade.

A regional office in Malaysia is being established alongside the head office at Griffith University, which has received international recognition for its contributions to our understanding of tephritid taxonomy, biogeography, ecology and pest management. This research provides important data for the teaching and training courses that will be conducted under the ICMPFF. Research projects in development incorporate scientists from all partici-

pating countries. The ICMPFF represents an unparalleled opportunity for Australia and ASEAN to develop a unified response to pest fruit flies - facilitating common, environmentally safe pest management strategies; the development of new market access technologies; and unified advocacy for international trade.

James Cook University

At the Townsville campus, a variety of projects are represented by the research efforts of the five entomology groups. **Helge Schlüns** from Germany has just joined **Ross Crozier's** lab as a new postdoc, working on the molecular biology of honeybees under a project shared with **Ben Oldroyd** (University of Sydney). He joins **Mark Bulmer** and **Angie Shuetrim** in studies on the molecular ecology (in the broad sense) of social insects (Mark is working on termite immune system genes and Angie those of ants). Mark Bulmer and Ross Crozier have made interesting findings concerning termite immune defence. **Rhondda Jones**, Professor Emeritus, is now able to devote more time to modelling insect movement and population dynamics. Research into the evolution and organisation of nest-weaving behaviour continues in the laboratories of **Simon Robson** and Ross Crozier. The molecular phylogeny of the ant genus *Polyrhachis* is nearing completion (thanks to the concerted efforts of many people: **Andy Beckenbach**, Angie Shuetrim, **Ching Crozier**), though we have become distracted by issues of frameshift mutations and its consequences. Angie Shuetrim is tracking down the genes responsible for fungal immunity in ants, and continues to work with Simon on the ecology of the *Polyrhachis sokolova*, the intertidal-nesting ant. Simon's interests have extended into the realm of biogeography and the organisation of ant data bases. Ross and Simon have extended their studies of *Polyrhachis* phylogeny to include an investigation of the endosymbionts of the genus (in collaboration with **Jennifer Wernegren** at Woods Hole) and have completed an evaluation of the ability of various biochemical markers to predict the age of individual, free-living insects. Simon's interests in the organisation of termite foraging continue to expand, and he will talk about a modelling + behavioural study at ICE.

Mike Henshaw's postdoc studies of the social organisation of the primitive wasp *Ropalidia revolutionalis* has come to an end. Mike leaves his JCU postdoc to take up a faculty position at McKendree College, near St Louis in the USA. Dragonfly larvae, their predatory behaviour and

their agonistic repertoires, continue to fascinate **Richard Rowe**. Interpretation is banging its head against the unsatisfactory state of our current knowledge of odonatan phylogeny. Richard is co-ordinating an international program to produce a book (tentatively titled 'Corbet's dragonflies' or 'The Big Book') to synthesise knowledge of dragonfly biology and to be a successor to **Philip Corbet's** monographs on the Order. Planned production date 2015. Richard is also developing a dragonfly database associated with the Global Biological Information Facility, and which is intended to mesh with projects developed by the Taxonomic Databases Working Group. This project is a natural follow-on to the Tree of Life web site he maintains with **John Trueman** (ANU). Recent graduate students have had a distinct leaning to the Chelicerata (**Claudia Arango** – Pycnogonida, **Bjorn Berge** – theraphosids, and now **Sara Ceccarelli** – salticid ant-mimics), but he also has **Chloe Cadby** working on predatory versatility in, and cognitive capabilities of, larval *Hemianax papuensis* (a dragonfly). **Anne Marie McKinnon** has just commenced an MSc looking at diapause and general ecology in tropical phasmids. **Kim Stephenson** is completing her B Applied Science degree with a major project looking at insect biodiversity changes with age of revegetation plots. **David Rentz**, now retired and living in Kuranda, spent time visiting **Mike Cermak**, **Jamie Seymour** and Anne Marie McKinnon to discuss phasmids. **Wendy Forno**, retired from CSIRO Indooroopilly, visited the campus and gave several lectures on plant biocontrol in the 3rd year entomology course run as an intensive on the campus in February. The proposed new undergraduate program in Veterinary Biology and Agriculture will most likely open further opportunities for entomological research.

Queensland Institute of Medical Research Mosquito Control Laboratory, Herston,

This institute is designated by WHO as an official global Collaborating Centre for Environmental Management for Vector Control, specializing in designing new mosquito surveillance and control strategies: <<http://www.qimr.edu.au/research/labs/briank/index.html>>. The brief of **Brian Kay** and **Peter Ryan** covers mosquito-transmitted arboviruses such as Ross River, Barmah Forest, Japanese encephalitis and dengue, and they have strong linkages with research groups in Vietnam and Cambodia, also with Queensland Health and Local Government.

Recent major achievements include the first eradi-

cation of dengue vectors from North Vietnam using biological control (predacious *Mesocyclops* spp.) and community participation. This program now protects over 400,000 people living in northern and central Vietnam, and with recent AusAID support (2004-2009) the group will implement similar programs in the Mekong delta area in southern Vietnam, and ensure that new water supply infrastructure is "dengue safe". The discovery that subterranean breeding of mosquitoes is of high importance to their survival during winter and dry seasons, and the design of a control strategy, is another achievement, as is the implication of grey-headed flying foxes and brushtail possums and several mosquito species as important in Ross River virus transmission

Michelle Gattton uses mathematical modeling and spatial statistics to investigate the role that environmental factors play in determining the overall disease prevalence, and also the occurrence of extreme transmission events in Queensland. The results of this type of analysis provide an opportunity to develop early-warning systems in which local regions can be notified of expected increases in transmission, allowing them time to respond with appropriate vector control. **Leon Hugo**, with **Scott O'Neill** (University of Queensland), is developing and evaluating new age-grading techniques for important arbovirus vector species, including cuticular hydrocarbon analysis and analysis of the expression of age related genes

Mosquito and Arbovirus Research Committee Inc.

MARC was formed in May 2000. The current members consist of 17 Local Government Cities or Shires (in Queensland, New South Wales and Victoria), the Queensland Department of Health, three Honorary Members and one Corporate Member. The founding group was formed in 1992 to support and promote research into biology, vector capacity and control of saltmarsh mosquitoes in SE Queensland and Tweed Shire of NSW. Membership has increased since those early days and the research program has also expanded to cover studies of fresh water mosquitoes, and vector competence and epidemiology of mosquito-borne diseases. The bulk of this research has been located at the Mosquito Control Laboratories in the Queensland Institute of Medical Research.

As part of its operation, MARC employs a full time scientist and supports a number of postgraduate students undertaking Masters and PhD degrees at QIMR. Current includes studies on native fish for

mosquito control, age grading and autogeny analysis of saltmarsh mosquitoes, field assessment of a new *Bacillus sphaericus* mosquito control formulation, assessment of vector competence of different strains of *Aedes aegypti* and dengue viruses from North Queensland, and studies of the biology of freshwater mosquitoes including *Coquillettidia linealis*, *Culex annulirostris* and *Ochlerotatus procax*. In the past, the research program has produced invaluable data to demonstrate the environmental soundness of products currently used in Australia for control of mosquito larvae, and unravelled interactions of the vertebrate hosts and mosquito vectors of Ross River and Barmah Forest viruses. MARC has an annual turnover approaching \$200,000 from member contributions. There is nothing like it anywhere else in the world

Army Malaria Institute

The Army Malaria Institute is involved with many aspects of protecting Australian Defence Force personnel against vector-borne diseases, especially malaria and arboviruses. The institute is involved with antimalarial drug development and evaluation of vaccines against arboviruses. The Vector Surveillance and Control Department of the institute has 3 entomologists and 2 technical officers. **Bob Cooper** is now Commanding Officer of the institute, and has spent much of his career investigating the distribution and biology of sibling species of malaria vectors, primarily the *Anopheles punctulatus* group in Australia, Papua New Guinea and Solomon Islands. He has also undertaken identification of vectors in East Timor, Vietnam and central China. **Stephen Frances** is interested in personal protection measures against vectors, and has conducted laboratory and field evaluations of repellents, and insecticide treatment of clothing and fabrics, as protection against mosquitoes. **Rob Marlow** is a recent graduate from the University of Adelaide and joined the institute less than a year ago. Technical Officer, **Cassie Jansen**, is a graduate from the Department of Microbiology and Parasitology, University of Queensland, and was recently awarded a university medal and first class honours for her thesis "Susceptibility of *Aedes aegypti* from north Queensland to synthetic pyrethroids".

SOUTH AUSTRALIA

South Australian Museum

Helped by funds from the National Heritage Com-

mittee, the aquatic beetle collection has recently been data-based – some 11,000 individual records. Included are the families Dytiscidae, Noteridae, Gyrinidae, Hygrobiidae, Haliplidae, Hydrophilidae, Spercheidae and Hydrochidae, but not Elmidae and Hydraenidae. **Chris Watts** is studying the rich subterranean diving beetle fauna of Western and Central Australian arid regions. Some 60 species have been described over the last few years and more have been discovered this southern winter. In addition to classical morphological studies we are investigating the evolution of these species using DNA sequence data. This indicates that most of the speciation took place between 5 and 10 million years ago which corresponds to the drying out of the Australian continent. Some cases of sympatric evolution appear probable. Companion studies by **Remko Leijds** are being undertaken on the 'evolutionary fate' of redundant genomes, concentrating on the vermilion and cinnabar genes which are involved in eye function.

A checklist of species and higher taxa of Australian Tenebrionidae is being prepared by **Eric Matthews** and **Patrice Bouchard** (Canadian Museum of Nature), working with **Alice Wells** of ABRS, Canberra who is entering the data for online retrieval. There are approximately 2,000 names and we are about halfway through, with an anticipated completion date of October 2004. <www.deh.gov.au/biodiversity/abrs/online-resources/abif/fauna/index.html>

Robert Lavigne conducts behavioral studies on the Asilidae (Insecta: Diptera) of Monarto Zoological Park, and carries out taxonomic studies on these flies, together with production of a database of Asilidae in the Museum collections. A predator/prey database for the Asilidae of the world has been produced, see <<http://www.geller-grimm.de/catalog/lavigne.htm>>

The mutual relationship between the ant *Camponotus terebrans* and the plant *Acacia sophorae* is being studied by **Archie McArthur**. In the first half of the 20th century, rabbits caused active sand-drift and the destruction of several hundred hectares of vegetation in Beachport Conservation Park. In the second half of the 20th century, following the reduction in rabbit numbers, *A. sophorae* gradually spread over most of the sand drift, stabilising it. The hypothesis is that minor workers of *C. terebrans* drag seeds of *A. sophorae* towards their nest, and on the way slice off portions of the seed's oleosome for carriage in their crops. With the crop full, the seed is abandoned and the ant scurries to the nest with its food. At the



Blepharotes corarius in Adelaide.
For behavioural studies see the journal
"Studia Dipterologica"



Camponotus terebrans with seed of
Acacia sophorae

study site, plentiful seed can be observed on the ground up to 70 meters from the nearest source ready for germination. The plant has its area of influence increased and the ant receives sustenance.

South Australian & Research Development Institute – Entomology Unit

The SARDI Entomology Unit is a research group within the SA government that focuses on applied entomological research and services. The Unit is co-located with entomologists from the University of Adelaide and is based at the Waite Precinct in the suburbs of Adelaide. Most activities of the Unit are supported by funding from Horticulture Australia Limited, the Grains Research and Development Corporation, and the South Australian and Commonwealth Governments.

A large part of inland Australia grows citrus within the fruit fly exclusion zone and this allows citrus to be exported without the need for disinfestation treatments for fruit fly. However, the control of 'hitch-hiker' pests of quarantine significance, such as lightbrown apple moth, is still required to maintain access to these markets. It has been recognised that the control of these pest is best achieved by a combination of field and postharvest handling procedures. A SARDI team, **Peter Tav-**

erner, Nancy Cunningham and Karolina Steciuk, is developing techniques to control surface dwelling pests using packingline processes to address postharvest decay, food safety and market access issues in an integrated manner. Another 'hitch hiker' pest of citrus, the small brown snail, has been the focus of the research by **Angela Lush**.

Greg Baker and **Kevin Powis** are developing an IPM system for Kelly's citrus thrips (*Pezothrips kellyanus*), a newly emerged pest of inland Australian citrus, integrating new insecticides with biological control provided by arboreal and soil-dwelling predatory mites.

Another snail research group within the Unit, **Dennis Hopkins, Megan Leyson, Kerrin Bell and Nathan Luke**, have focused their attention on white and conical snails that are major pests in broadacre grain crops across southern Australia. This project is collaborative with several other research agencies and is developing an integrated management strategy involving stubble management, baiting, natural enemies, machinery modifications and new grain cleaning options.

The Unit is involved in a Fire Ant Surveillance and Awareness Program which commenced in January 2002 as part of a national strategy to prevent the spread of the fire ant (*Solenopsis invicta*) to

areas outside the Brisbane infestation zones. **Bill Kimber** has carried out intensive ant surveys of designated sites and industries at high risk from fire ants and to date has not detected any incursions of this species in South Australia. Publicity Officer, **Dijana Jevremov** has facilitated an awareness program targeting high-risk industries and the general public.

There is a national effort to target the weed, Paterson's curse, with insect biocontrol agents. Currently **Ken Henry** and **Susan Ivory** are coordinating and running the South Australian component of this program that is concentrating on the release of four beetles which attack various parts of the target weed.

Periodically fruit fly outbreaks occur in Adelaide with incursions from either the west (Medfly) or the east (Qfly). The current control strategies for these outbreaks involve the use of spot baiting and the release of sterile fruit flies and this operational program is supported by research conducted by Unit entomologists, **Dennis Hopkins**, **Catherine Smallridge** and **Vanessa Bosco** in collaboration with entomologists from both WA and Queensland. The western flower thrips (WFT) is a relatively new arrival in South Australia that has caused very significant losses to the vegetable industry based on the northern Adelaide Plains. **Tony Burfield** and **Gabriella Caon** are involved in an IPM program in this area which has led to a vast improvement in the way growers manage this pest. Onion thrips is the key pest confronting the Australian onion industry, and **Greg Baker** and **Kevin Powis** are involved in a new project that aims to develop an IPM program. The WFT work meshes in with a new project in the unit called 'Revegetation by Design'. The project involves a new concept where the focus is to use native vegetation to reduce pests and diseases of horticulture and increase natural resources. By demonstrating benefits that native vegetation may offer, the project hopes to change the community perception towards the maintenance of natural resources. The project has a multidisciplinary team with **Nancy Schellhorn**, **Glenys Wood**, **Dijana Jevremov**, and **Tony Burfield** from SARDI and representatives from local government, the Virginia Horticulture Centre and private consultant scene.

Greg Baker and **Chris Krawec** are studying *Etiella behrii* (Pyralid) which has become a pest in lentils where the larvae damage seed and create a quality issue. The research is focussed on developing prediction and monitoring systems to assist with the decision making process to enable the correct

timing of pesticide applications. The Unit has also played an on going role in developing new baiting control tactics for European wasps in urban and rural environments. During the 2003/04 summer, the wasp team, of **Dennis Hopkins**, **Nola Lucas**, **Kym Perry** and **Paul Hastings** did contract work for Bayer CropScience assessing a range of different pesticides, bait matrices and bait preservatives.

Biological Services – Loxton

With **James Altmann** as Manager, Biological Services rears biocontrol agentss for IPM systems, and does monitoring and consultancy in citrus, grapes, pome/stonefruit, avocados, and almonds crops. At present we are commercially rearing *Aphytis melinus*, *Encarsia formosa*, *Hypoaspis* mites, *Galendromus occidentalis* for biological control in IPM programs. A new insectary is being built to increase production, with the intention that making commercially available cultures of local *Aphidius*, *Eretmocerus*, and thrips predators over the next year.

The University of Adelaide Department of Applied and Molecular Ecology, Waite Campus

The Insect Evolution and Ecology Group is headed by **Andy Austin**, who is also Director of the University's Centre for Evolutionary Biology and Biodiversity <www.ees.adelaide.edu.au/research/cebb/>. In addition, this group comprises **John Jennings**, three postdoctoral fellows, nine postgraduate students, and two honours students. The group is undertaking a range of research projects that focus on various aspects of the systematics, evolution and biodiversity of insects and spiders. Major projects include: the molecular systematics, evolution and taxonomy of hymenopteran parasitoids, particularly Braconidae, Scelionidae and Gasteruptionidae (Austin, Jennings, **Nick Murphy**); the molecular systematics of lycosid spiders (Murphy, Austin); the population genetics, phylogeography and ecology of subterranean aquatic arthropods, ie. stygofauna (Austin, **Steve Cooper**, SA Museum, **Michelle Guzik**, **Colin Clay**, PhD student); and the evolution of reproductive strategies in thrips (**Brenda Kranz**). Postgraduate projects being undertaken in the group include research on ants as indicators of habitat recovery in the Flinders Ranges (**Sylvia Clarke**); the ecology of spiders inhabiting artesian springs in arid South Australia (**Travis Gotch**); the ecology of guanophilic arthropods in the Naracoorte Caves

World Heritage Area (**Tim Moulds**); the molecular systematics of the *Cotesia flavipes* complex of parasitoids (Braconidae) that parasitise stemborer pests (**Kate Muirhead**); the ecology and biodiversity of insect communities in Coonawarra vineyards (**Cate Paul**); the impact of the weed bridal creeper on the diversity and community dynamics of arthropods in native vegetation (**Claire Stephens**); and the systematics of Australian agathidine wasps (Braconidae) (**Nick Stevens**). The group has strong collaborations with the SA Museum, WA Museum, CSIRO Canberra, and a number of overseas research groups.

Faculty of Agriculture and Wine, Waite Campus Insect Systematics Laboratory

The research group is closely linked to the research group headed up by Andy Austin. We are currently involved in a range of projects in evolutionary biology and systematics, ecology, biodiversity and conservation biology, and bioinformatics

Projects include: the phylogenetic systematics of Australian Gasteruptionidae and Aulacidae (Hymenoptera) (John Jennings, Andy Austin and Nick Stevens); survey of antennal sensilla and other antennal structures in the Evaniioidea (Hymenoptera: Evaniioidea) (**Penny McLachlan**, Honours student, John Jennings and **Remko Leijts**); development of an interactive identification key to Australian hymenopteran families (Andy Austin, **Muhammad Iqbal**, John Jennings and Nick Stevens); taxonomy, biology and co-speciation of the symbiotic association of *Fergusonina* flies (Diptera: Fergusoninidae) and *Fergusobia* nematodes (Tylenchida: Sphaerulariidae) causing galls on *Eucalyptus*, *Melaleuca* and other Myrtaceae (**Gary Taylor** and **Kerrie Davies**) (USDA); the effect of fire on *Eucalyptus cneorifolia* communities on Kangaroo Island: using ants as bio-indicators (**Fraser Vickery**, PhD student, John Jennings and **Sandra Taylor**); data-basing agriculturally significant insects, mites and nematodes in the Waite Insect and Nematode Collection (led by John Jennings); and development of a checklist and website to the Australian Hymenoptera (Andy Austin, John Jennings and Nick Stevens). The group also maintains the Waite Insect and Nematode Collection <<http://www.sciences.adelaide.edu.au/research/winc/>>, a research and quarantine collection that comprises some 500,000 insect, nematode and mite specimens.

Otto Schmidt's group has found that tolerance to a *Bacillus thuringiensis* formulation in a laboratory

colony of the flour moth *Ephestia kuehniella* can be induced by pre-exposure to a low concentration of the Bt-formulation and that the tolerance correlates with an elevated immune response. The data also indicate that both immune induction and Bt-tolerance can be transmitted to offspring by a maternal effect and their magnitudes are determined by more than one gene (*Proceedings of the National Academy of Sciences* (USA) 101, 2696-2699, 2004).

The discovery of a novel, inducible resistance mechanism, will have a major impact on the development of strategies to control insect pests and insect vectors of disease using *B. thuringiensis* endotoxins and baculoviruses. The new Bt-resistance mechanism is based on the assumption that a pro-coagulant in the gut lumen interacts with lectin-like toxin and inactivates the toxin before it can reach the Bt-receptors on the brush border membrane. The new mechanism is consistent with indirect evidence from linkage mapping that genes unrelated to Bt-receptors are involved in resistance and adds a new dimension to existing models, which assume inactivation of cell-bound Bt-receptors, such as aminopeptidase N and cadherin-like adhesion molecules. Otto's group has indirect evidence that other pathogens that use similar sugar-determinants to attach to gut cells may be inactivated by the same mechanism. The model implies a soluble receptor-like decoy, protecting cells from toxins and pathogens, which can serve as a paradigm for other host pathogen systems, such as the gut lining of vertebrates.

Flinders University, Adelaide

The origin of insect sociality has been a central question in evolutionary biology since the inception of evolutionary theory. Research in **Michael Schwarz's** lab contributes to this debate by revealing historical patterns of character traits that have been thought to be important to the evolution of insect social behaviour. We have taken two distinct but complementary approaches to this: Firstly, we have been using DNA-sequence methods to develop robust phylogenies for our focal taxa; and secondly, we have used observational and experimental field-based work to uncover and explore key traits for these same taxa. Phylogenetic topologies are then used to infer transitions in key traits and explore likely causal agents. Taxonomically we have focused on the allodapine bees throughout their Old World, austral, and southern Asian distribution, and the Australian gall-inducing *Acacia* thrips. We have also recently expanded

our taxonomic breadth with the addition of projects on the wood-feeding cockroaches of Australia and Southern Africa and the leaf-cutting ants of Panama. We are always very interested in collaboration, so please feel free to talk to us.

Allozapines bees. The stem nesting allozapine bees have been a focal group in social evolution studies over the past few decades. They display unusual brood rearing tactics, involving extensive adult-larval contact in a cell-less environment, providing a unique route to social complexity. Allozapines are facultatively social, ranging from subsocial to highly social both within and between taxonomic groups, making them well suited to comparative methodologies. Projects initially concentrated on intrinsic and extrinsic factors influencing sociality in the endemic Australian taxa, but the scope of our research has more recently expanded to include African clades. Our molecular studies conflicted with earlier cladistic work based on morphological and behavioural traits, leading to a major paradigm shift for social evolution in this tribe. Combined with newly acquired life history data it has become apparent that sociality is plesiomorphic for the tribe, with an origin that predates the divergence of the extant lineages (~ 35MYA). Research is now exploring the historical biogeography of the tribe, involving dispersal-vicariance analyses, estimation of divergence times for divergence events, and how these align with current plate tectonic theories.

Thrips on Australian Acacia. More than 250 species of phlaeothripines show a close life-history association with Australian *Acacia*. Each species, or sibling species, of *Acacia* thrips appears to specialise on a single host *Acacia* species. Each host *Acacia* harbours a small number of *Acacia* thrips species that exploit the plant in various ways while some species specialise in exploiting other *Acacia* thrips. We currently have projects looking at the co-evolution of host and parasite (*Acacia* thrips parasitising the host tree, and kleptoparasitic *Acacia* thrips attacking gall-forming *Acacia* thrips), but our primary focus has been to study the evolution of a defensive specialist or soldier caste using a phylogenetic comparative approach. These soldiers appeared 5-15 million yrs ago within the gall-inducing suite of *Acacia* thrips species. Soldiers have greatly enlarged fore femora, which have been shown to be an adaptation for gall defence against arthropod invaders, specifically species of *Koptothrips*. Our projects investigate the role of sex allocation and kleptoparasites in the origin and subsequent evolution of sociality within this interesting group of species. <[http://](http://www.scieng.flinders.edu.au/biology/people/schwarz_m/mps/mpspersonnel.htm)

www.scieng.flinders.edu.au/biology/people/schwarz_m/mps/mpspersonnel.htm>

The University of South Australia

Joanne Kent is currently writing her PhD "The Systematics of the *Culex sitiens* Wiedemann subgroup species complex and examination of the population dynamics of *Culex annulirostris* Skuse within Australia, Torres Strait and Papua New Guinea". It has been a combination of morphological and molecular data and she is aiming to submit it in mid-September. Whilst she is still enrolled at the Uni of SA, a large amount of the work was done at the University of Queensland, in the Centre for Identification & Diagnostics (unfortunately, that particular lab no longer exists).

The Mosquito God of the Australian Heath

Why did God create mosquitoes? A group of Australian heath plants belongs to the family Epacridaceae. They are often prickly obscure little plants that you would normally miss until they flower. Some in South Australia, like *Epacris impressa*, are showy and brilliant in the spring. Others, like *Acrotriche patula*, have obscure little flowers that are reminiscent of fictional aliens.

When thinking of the pollinators of Epacrids, it is easy to assert that birds play a major role. However, a look at the tiny and obscure flowers of some species (e.g. *Acrotriche patula*), strongly suggests the involvement of insects. Herein lies a problem, at the time that these species flower (early spring to summer), temperatures are low and insects are not abundant. There is one notable insect exception, the winter mosquito, *Ochlerotatus camptorhynchus*. This large, dark mosquito emerges from its pools in late winter and can be seen along South Australian coast where it will bite the unprepared winter walker. It seems to prefer water that is slightly salty for its breeding. The winter mosquito is a great wanderer and has been known to move up to 10 km from its breeding grounds.

All this led **Daniel Duval** and **Michael Kokkinn** to wonder whether the winter mosquito could be a major pollinator of heath plants. They found a flowering stand of *L. parviflorus*, set some mosquito traps between the plants, cut off some branches bearing flowers and brought them into the laboratory to observe mosquito behaviour. Observations confirmed that mosquitoes were major consumers of nectar from these plants. There was no doubt that there is a close association between *L. parviflorus* and *O. camptorhynchus*; they might even

be the major pollinators. Since mosquitoes can see in the ultra violet range, *L. parviflorus* flowers were observed under ultra violet light. Miraculously, the tips of the anthers of each flower shone like welcoming beacons and the bowls glowed golden as if to signal the presence of nectar.

Why did God create mosquitoes? *To pollinate the beautiful heaths of course!*

TASMANIA

Forestry Tasmania

This organisation is the government business enterprise that manages Tasmania's state native forests and plantations. It employs several staff with an entomology remit in the Division of Research and Development. <<http://www.forestrytas.com.au>>

Simon Grove is the organisation's conservation biologist, with a strong research focus on the use of invertebrates in measuring and monitoring forestry impacts and in conservation planning. Coarse woody debris and saproxylic insects are his particular interest, but Simon oversees a range of biodiversity research projects around the State, particularly at the Warra Long Term Ecological Research site in Tasmania's southern wet eucalypt forests <<http://www.warra.com>>.

The focus of **Jane Elek's** research is on developing IPM systems that are efficient at preventing economic damage by leaf beetles, autumn gum moth, *Gonipterus* weevils and other insect pests in Tasmanian eucalypt plantations. Doing so involves research on maximising the effectiveness of natural enemies, biological control and environmentally benign chemicals (including pheromones and Bt-based insecticides). She is also involved in IPM extension, monitoring and training.

Dick Bashford operates insect pest monitoring and control programs, as part of a larger forest health surveillance program conducted by **Karl Wotherspoon, Nita Ramsden and Sue Jennings**. Dick's projects include a port surveillance program to detect incursions by Asian gipsy moth and other exotic forest pests, and the use of nematodes to control *Sirex* wood wasp in pine plantations. Dick also maintains the Tasmanian Forest Insect Collection, which houses specimens from a range of FT and non-FT projects. Entomology research in the Division is currently supported by technical officers **Alison Phillips** and **Belinda Yaxley**.

University of Tasmania, School of Agricultural Science

The entomology research in SAS focuses on insect behaviour from its evolution to its application in pest management. It is led by **Geoff Allen** and currently includes both post-doctoral and graduate researchers. Specific research areas are host location, insect mating systems and inter-specific interactions between plants, herbivores and their natural enemies. Expertise within the university in molecular and quantitative genetics and organic chemistry support this research. Entomology is also taught at an undergraduate level to students in Agricultural Science, Science and Environmental Science.

A major research focus of the insect behaviour group is forest eucalypt insects with a large component funded through the CRC of Sustainable Production Forestry. Among the more innovative research that is being undertaken is on the chemical basis of plant-insect interactions with a focus on elucidating the mechanisms and genetic basis of resistance in eucalypts. Significant outcomes have included the identification of specific wax benzyl esters as well as foliar tannins of juvenile leaves of *Eucalyptus globulus* that are involved in the susceptibility of *E. globulus* to autumn gum moth (*Mnesampela privata*) attack and the first confirmation that feeding kairomones are involved in the mate location behaviour of eucalypt feeding chrysomelid leaf beetles. Research on the parasitoids associated with eucalypt feeders has also led to collaborative research with New Zealand scientists on the biocontrol of several eucalypt forest insect pests. The group has access to an excellent base of pedigreed genetic material of *Eucalyptus*, particularly for the major temperate plantation species *Eucalyptus globulus* and *E. nitens*. A large experimental base of 1st and 2nd generation hybrids of these species has also been established in Tasmania.

Another significant collaborative research area in SAS is the biology of weed biocontrol agents. This research targets the efficacy and integration into IPM of weed biocontrol agents and is in collaboration with **John Ireson** (Tasmanian Institute of Agricultural Research). Finally, we are currently developing a new research area, led by horticultural researchers, into the pollination behaviour of insects with funding from the vegetable seed production industry.

VICTORIA

Department of Primary Industries, Knoxfield

Current major activities in the insect taxonomy section led by **Mali Malipatil** include: identification of pest and beneficial arthropod species for R&D projects and for biosecurity activities undertaken by the departmental staff across Victoria; taxonomic research on Heteropteran bug families Reduviidae, Lygaeidae and Miridae, and of Macropsine leafhoppers (Cicadellidae); molecular diagnostic work on adults and nymphs of aphids and adults and larvae of pest fruit flies; curation and databasing of Victorian Agricultural Insect collection; training of Victorian state quarantine officers and other department staff and commercial growers in the identification of pest and beneficial arthropods; and fee-for-service pest diagnostic work for home garden and commercial clients

Centre of Environmental Stress and Adaptation Research

The Centre of Environmental Stress and Adaptation Research at La Trobe and Monash Universities, Melbourne, is undertaking research on the ways insects adapt to environmental stresses, including insecticides, climatic stresses, and pollutants. Recent exciting findings from this group include the following: (1) Rainforest *Drosophila* have a very limited potential to adapt to desiccation stress, increasing their likelihood of extinction under climate change, and raising the general hypothesis that distribution limits in invertebrates are tied to genetic variance in key ecological traits. (2) Chironomid species can differ markedly in their response to pollutants including heavy metals, nutrients and hydrocarbons. By using DNA markers, the different species can be rapidly sorted, providing pollution signatures that can be readily applied to urban aquatic monitoring in greater Melbourne and other regions. (3) There are novel genes that encode resistance to a number of different pesticides at a high frequency in natural populations of insects, even when these populations have not been exposed to pesticides. (4) Clinal patterns in widespread insect species along the eastern coast of Australia provide a powerful means of isolating genes and traits under climatic selection, and isolating genes that contribute to adaptive shifts. CESAR runs a substantial program on integrated pest management, the development of molecular markers for identification of cryptic species and for examining population structure of pest species, the discovery of resistance genes for novel pesti-

cides, and the development of invertebrates for sustainability. Findings include the following. (1) Shelterbelt plantings and remnant vegetation bordering pasture areas and vineyards can have a large impact on the distribution of both pest and beneficial invertebrates in pastures and vineyards. This suggests ways of integrating shelterbelts and remnant blocks into pest management strategies. (2) Management practices in vineyards aimed at controlling soil moisture can impact on the distribution of pests and beneficials in vineyards both at ground level and in the canopy. (3) Chemicals that are soft on beneficials in mortality tests can decimate populations by influencing reproduction and lead to secondary outbreaks of pest species. (4) Grape phylloxera comprise clonal strains with different biological attributes that contribute to their potential to invade new vineyards. (5) Chemical and cultural strategies for controlling earth mites in crops and pastures need to be tailored to individual species of mites because of differences in chemical tolerance and diapause strategies. (6) Genetic markers indicate that there is a high level of gene flow among diamond backed moth populations in Australia, making national programs for the control of this pest essential.

University of Melbourne

Department of Zoology, Animal Behaviour and Evolution

Mark Elgar's group is addressing a broad range of questions in evolutionary biology from the chemical ecology and social behaviour of pest species, through to the bizarre mating system of an Australian waterstrider whose females provide their mates with nuptial gifts. They are investigating the role of chemical communication in social insects, with a particular focus on nestmate recognition and antagonistic interactions, using the meat ant *Iridomyrmex purpureus*, the Argentine ant *Linepithema humile* and *Tapinoma* spp. as model species. Their work also involves studies of myrmecophilic species, especially spiders. The group has a long-standing interest in the foraging behaviour of spiders, especially orb-weaving spiders, and especially the mechanisms these spiders use to increase their foraging efficiency. One mechanism is to exploit the sensory systems of potential prey, the spiders using chemical cues to lure their prey.

Aspects of sexual selection and the evolution of mating systems in several insects and spiders are also being investigated. Studies on spiders focus on how sexual conflicts, especially those arising

through sexual cannibalism, influence male and female mating strategies. The impact of male age and mating history on fertilisation success in two introduced pest species, the hide beetle *Dermestes maculatus* and the almond moth *Ephestia cautella*, is being studied, also new studies on *Plodia* and earwigs. Together with **Göran Arnqvist** (Uppsala University) the mating system of a newly discovered Australian water strider, the Zeus bug, *Phoreticovelia disparata*, is being examined. The tiny male Zeus bugs are less than half the size of females and spend the vast majority of their lives riding on the backs of their mates where they feed from custom-made female glandular secretions. This is the first evidence of a female nuptial gift, and opens up a range of intriguing possibilities for the evolution and maintenance of nuptial feeding.

Department of Genetics

Jon Martin and **Yvonne Parsons** (CESAR, LaTrobe University) are performing a preliminary genetic investigation of zinc tolerance in the rice midge, *Chironomus tepperi* Skuse. Initial investigations have indicated that a population of *C. tepperi* from near Yanco, NSW shows tolerance to considerable levels of ZnCl₂ in laboratory exposure experiments, probably as the result of the application of zinc to rice paddies in recent years. The level of zinc tolerance in this population is currently being further investigated in the CESAR lab, where Yvonne is assisted by an Honours student, **Kana Hoshikawa**. At Melbourne, Jon and his Honours student **Melissa Hind** are isolating and physically mapping genes known to be involved in heavy metal metabolism. The aim of these studies is to determine the extent of zinc tolerance in natural populations of *C. tepperi*, identify the genes which confer this tolerance, and to evaluate the possibility of using the upregulation of such genes in *Chironomus* for the early identification of increasing levels of pollution in natural water bodies.

Forensic Entomology Group

University of Melbourne and Victorian Institute of Forensic Medicine

Honours student **Clare D'Alberto** (Melbourne University) recently completed a project on behavioural interactions between the predaceous calliphorid maggot, *Chrysomya rufifacies*, and one of its prey species, the fellow calliphorid maggot *Calliphora stygia*. Deakin University honours student **Josh Gunn** (co-supervised by **Simon Lewis**, **Tess Toop** and **Melanie Archer**) began his work in February on extraction of opiates from calliphorid

larvae using novel methods. Melanie has been fortunate enough to undertake two missions this year to the Solomon Islands for Operation RAMSI, assisting forensic pathologist **Malcolm Dodd** with autopsies on civil war victims. This gave her a rare opportunity to collect calliphorids and sarcophagids from several remote villages on Guadalcanal Islands.

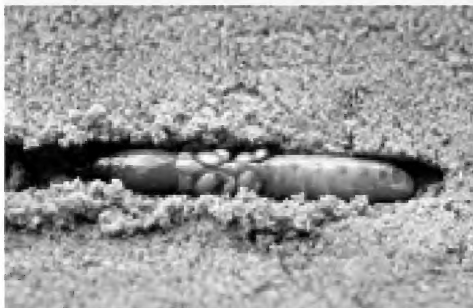
WESTERN AUSTRALIA

WA Museum Entomology

Terry Houston, whose research field has long been the systematics and biology of native bees, has more recently pursued a study of the biology of sandgropers. These large, wholly subterranean insects are descended from the grasshoppers, forming the family Cyndrarchetidae in the order Orthoptera. There are 14 species described from Australia, one (putatively) from New Guinea and one from South America. Previously, none of the species had been studied in any detail and their life cycle stages were incompletely known. This lack of study is remarkable given that farmers in the northern wheatbelt of Western Australia blame sandgropers for destroying hundreds of hectares of cereal crops and pastures. The occurrence of two species of sandgropers in and around Perth and their abundance in near areas of the wheatbelt provides an ideal opportunity to fill a void in our knowledge of them. Through the cooperation of a number of farmers, Terry has been able to uncover the complete life cycle of the insects, document the diet of both adult and immature stages and obtain information on their breeding and population structure throughout the year. The insects have been found to display a number of unique features, both morphological and behavioural. As a corollary to the study of sandgropers, Terry has been uncovering some interesting facts about the look-alike mole crickets occurring in WA. Two species that are now common in Perth gardens have proven to be introduced from eastern Australia, and some "named" native species have proven to be undescribed.

Western Australia Agriculture

PestFax is a weekly newsletter/update of the latest information on insect and disease pests of broad scale crops in Western Australia and provides an important and timely means of information gathering and dissemination of pest and disease information to industry with weekly updates and



Sandgropers - removed from and within a tunnel

reports. It provides an information service direct to growers and industry to help achieve maximum yield and quality for the least cost. It is produced by the Entomology Section of the Department of Agriculture in WA during the winter cropping season. The service relies on weekly reports of invertebrate pest outbreaks and disease observations from its readership throughout the WA cropping belt. Farmers support PestFax on a volunteer basis by servicing a grid of pheromone traps across the cropping regions. The traps provide information on native budworm (*Helicoverpa* spp.) flights and larval activity. The service is available via direct e-mail or through the <website, www.agric.wa.gov.au> (search on the word PestFax).

Sterile Medfly Production in Western Australia

The Mediterranean fruit fly, *Ceratitis capitata*, is widely distributed in Western Australia, having been accidentally introduced into WA a century ago. It is found in large numbers throughout the Perth metropolitan area and in many rural centres from Broome to Esperance. It has not established populations elsewhere in Australia. Sterile flies are being used with good success as part of Medfly control programs in country Western Australia. How-

ever, the main client is the South Australian government which employs SIT technology to eradicate, on average, two outbreaks in Adelaide each year. Current research is focused on the potential of ginger root oil to enhance the mating competitiveness of sterile flies to increase their effectiveness when released. The long term aim is to eradicate Medfly from Western Australia, and hence Australia, but eradication costs need to be significantly reduced before this becomes economically feasible.

Integrated pest management in citrus in Western Australia

Although citrus IPM programs have been developed for Queensland, New South Wales and South Australia, a long-term pest management program needs to be specifically developed for WA, which has a different climatic and cropping pattern from the other states. Little is known of the pest, parasite and predator complex present in WA citrus. In WA the major impediment to the adoption of IPM has been the use of cover sprays for control of Mediterranean fruit fly, the primary insect pest of citrus. We have demonstrated to growers that Medfly can be controlled using IPM-compatible bait sprays, rendering the uptake of an IPM program far more achievable. Preliminary data suggests that scale insects, particularly red scale (*Aonidiella aurantii*), are the main secondary pest in WA. Seasonal pests include citrus leaf-miner (*Phyllocnistis citrella*) and black citrus aphid (*Toxoptera citricida*).

Western Flower Thrips

Western Flower Thrips, *Frankliniella occidentalis*, is a recent introduction to Australia. WFT were first detected in Perth in 1993. WFT cause direct damage to crops through feeding on fruit and flowers, and indirectly through transmission of the tomato spotted wilt virus. Wide ranges of crops are affected including vegetables, ornamentals and fruit crops. Current research, in collaboration with **Grant Herron** (NSW Agriculture), is focused on evaluating new insecticides, but because WFT develops insecticide resistance, pesticides are not a viable long term solution and an integrated pest management approach must be developed. There are, however, few other control methods currently available to Australian growers. For example, biological control agents that are highly effective overseas are unlikely to be approved for release here due to Australia's quarantine regulations. Nevertheless, other control methods need to be explored.

Pests in high rainfall areas

Crops in high rainfall areas of Australia encounter a greater diversity of pests and greater populations of some pests when compared to lower rainfall areas. Current Grains Research and Development Corporation funded projects are focusing on canola pests against which insecticides are not highly effective, such as bronzed field beetle larvae (*Adelium brevicorne*), false wireworm (*Gonocephalum walkeri*) and European earwig (*Forficula auricularia*). Weevils such as the Fuller's rose weevil (*Asynonychus cervinus*) and small lucerne weevil (*Atrichonotus taeniatulus*) are sporadic pests of canola and can be difficult to locate. Emerging pests of canola in Australia are Balaustium mite (*Balaustium medicagoense*) and clover mite (*Bryobia praetiosa*), which each have different chemical controls, but are difficult to differentiate. Efficacy trials on the two mite species, European earwig and the weevils are being conducted this year. We are conducting final trials to determine the impact of stubbles in crop rotations on false wireworm. During harvest bronzed field beetle adults are found to be a major contaminant of grain and consequently some farmers are being docked at the grain receival points. Trials are continuing on the best harvest practices to minimize insect contamination of grain.

Pest management in horticulture in the southwest of WA.

Research and advising farmers on horticultural pest issues in southwest of western Australia is centred at the Manjimup Horticultural Research Institute, south of Perth. The Institute is centrally located in relation to the state's major horticultural industries. The main crops serviced include viticulture, vegetables, with an emphasis on potatoes and brassicas, and deciduous tree fruits. The main pests are beetles, with an emphasis on weevils, mealybug and mites, but some activities involve pest Lepidoptera such as diamondback moth (*Plutella xylostella*) and leafrollers (Tortricidae). A research emphasis is placed on monitoring to treat pests on demand. Insecticide trials form part of the research on pest control, as well as assessing the role of natural control agents, including the role of birds as predators of pests. Pest management training programs for apple orchardists is a recent initiative to encourage monitoring and employing soft options for pest management. An information exchange between researchers, commercial crop monitoring consultants and chemical company representatives in the region helps to keep all parties

up to date with pest issues in horticulture.

Alternatives to methyl bromide treatment for export of sweet corn

The sweet corn industry in Australia is relatively small at present, but has the potential to become a strong export oriented industry. The pests found on intercepted produce include aphids, thrips, mites, moths (*Helicoverpa* eggs and young larvae) and beetles. Effective postharvest disinfestation treatment of produce is essential to satisfy the zero tolerance of live insects required by overseas quarantine authorities. Stored corn is currently fumigated with methyl bromide; this has the disadvantage of causing browning of the green sheath covers of the corn cob and can induce "off flavours" in stored corn. Alternatives are required and include phosphine, ethyl formate, propylene oxide, and sulfuryl fluoride. Methyl bromide will shortly be banned in most OECD countries.

When fumigated with phosphine, the treated produce did not show any phytotoxicity. However, the long exposure period required for phosphine does not make it attractive for exporters. Ethyl formate occurs naturally in a range of products and is not classified as hazardous. Initial tests demonstrate complete insect control and treated produce did not show any phytotoxicity. Ethyl formate is now being presented for registration, and a draft treatment protocol is being prepared.

Western Australian Department of Conservation and Land Management

The *ForestCheck* project involves the long term monitoring of forest biodiversity as impacted by forest management silvicultural practices such as different logging regimes. Autumn sampling was completed in March this year. This past sampling season was located in the Perth Hills District. Former sampling areas have been located in Donnelly and Wellington Districts. We have now accumulated more than 900 invertebrate morphospecies over the past three sampling years. The invertebrate team are **Janet Farr**, **Tom Burbidge** and **Allan Wills**.

The new *Fire Mosaic* project aims to study the impact of applying a landscape mosaic burning regime compared with the low intensity control burns currently used as a management strategy. Two CALM entomologists, Janet Farr and **Paul Van Heurck**, attended a meeting to finalise sites for the project. The project will involve a wide range of expertise and will rely heavily on GIS technology. Following the meeting, Paul got stuck into some

sampling with some eager Forest Rangers, a group of local school children interested in the environment and invertebrates. Paul is also associated with a group of dedicated local volunteers who are establishing a collection of invertebrate fauna of the Nuyts Wilderness. CALM would like to connect with university students interested in conducting studies under the Fire Mosaic or ForestCheck projects.

Database of South-West forests terrestrial insects. Thanks to a grant of \$30,250 awarded to the Western Australian Insect Study Society from the Gordon Reid Foundation for Conservation and Lotterywest, more than 17,000 insect specimens from Western Australia's South-West forests have been databased. The database, called "Bugbase", will be available at CALM's Science Division web site <<http://science.calm.wa.gov.au/bugbase>> This is linked to the WAISS web site, Nature Base, the Western Australian Department of Agriculture's web site and the main state and federal insect collection web sites. The collection is housed at CALM's Kensington research centre and is managed by Tom Burbidge.

Curtin University, Department of Environmental Biology

M.J (Maze') de Sousa-Majer has successfully finished her PhD project, coordinated by **TJ Higgins**, on the evaluation of the efficacy of transgenic peas against the pea weevil (*Bruchus pisorum*). Maze' Majer was based on the WA Dept of Agriculture where she was co-supervised by **Byron Lamont** (Curtin University), **D.Hardie** (WA Ag), **Neil Turner** (CSIRO) and **Rick Roush** (ex-CRC Weed Research). Her study has confirmed that transgenic peas with the α -AI-1 inhibitor expressed in their seeds effectively controlled the pea weevil. The major finding of her study is that heat stress reduced the level of α -AI-1 in the transgenic peas, making them much more susceptible to pea weevil attack when compared with plants grown without heat stress. Maze' believes that the efficient cultivation and commercial success of transgenic plants depends on the continued expression of the introduced genes during environmental stresses. Her field trials with transgenic peas indicated that, relative to the non-transgenic plots, growth rates of weevil populations were reduced by 97–98% in the transgenic plots. Planting mixture of transgenic and 10–20% non-transgenic seeds is a promising strategy for optimising resistance management. Maze' is cur-

rently looking for an opportunity to put her knowledge into practice, and to help do the risk and assessment and protocols to monitor the release of any transgenic plants in Australia.

Murdoch University

Modika Perera and **Michael Jones**, from the Plant Biotechnology Research Group, are investigating novel sources of insect/aphid resistance genes and control of their expression in grain legumes. The aims of this research were to study gene promoters to control expression of genes that confer insect resistance, to introduce insect/aphid resistance genes into lupins, and to search for potential new sources of resistance to aphids that could be used in molecular approaches for insect resistance. To study gene expression, a plant expression cassette was made with reporter genes GUS and GFP driven by the peroxidase gene promoter *Shpx6b* from forage legume *Stylosanthes humilis* (**J M Manners** -CRC Tropical Plant Pathology, Qld). This cassette was introduced into tobacco to study gene expression of the linked genes during attack by chewing and sucking insects. We also collaborated with Key Gene, the Netherlands, to study the transformation of aphid susceptible narrow-leaved and yellow lupins with the *Mi* gene, which belongs to the NBS-LRR family of resistance genes and is reported to confer resistance to nematodes, aphids and whiteflies. Cowpea aphid, *Aphis craccivora*, bluegreen aphid, *Acyrtosiphon kondoi*, and green peach aphids, *Myzus persicae*, were used to screen grain legumes that have natural resistance to these aphid species. The leaf surface structure were studied and compared and aphid stylet tracks in resistant and susceptible cultivars were examined during aphid feeding. *L. albus* has effective aphid resistance despite having the low alkaloid content. Further studies to understand mechanism involved in this aphid resistance in *L. albus* are in progress. This part of the work was carried out in collaboration with the Murdoch University-Plant Physiologist **Berni Dell**.

Modika Perera, Allan Knight, Allan Barton, Ruben Flores Vargas and **Robert Emery** collaborate on a related project, evaluating eucalyptus oil and it's major component 1,8 cineole to develop a potential fumigant against stored grain pests such as rust-flour beetle, *Tribolium castaneum*, and lesser grain borer, *Rhyzopertha dominica*. The Aquatic Ecosystems Research Group (**Jenny Davis, Jane Chambers, Karin Strehlow, Lien Sim, Suzi Wild and Jacqui Giles**) in the School of Environmental Science has moved into research

on saline ecosystems. As a result, we are not finding very many insects; these are definitely crustacean-dominated systems. One insect that does do particularly well in moderately saline systems is the damselfly, *Austrolestes annulosus*. We continue to monitor the wetlands on the southern Swan Coastal Plain and now have more than ten years of biomonitoring data. These freshwater systems have a large diversity of aquatic insects. Results indicate, perhaps not unexpectedly, that richness is highest when winter rainfall is high.

At the Centre for Rhizobium Studies, **Wayne G. Reeve, Regina Carr and John Howieson** are constructing a *Sinorhizobium meliloti* genotype to deliver a Bt toxin to the nodules of annual medics for control of Sitona larvae. Pasture productivity of annual and perennial medics depends heavily on the ability of *Sinorhizobium meliloti* to nodulate and fix nitrogen in symbiosis with *Medicago*. However, the nitrogen fixation process is disrupted by nodule grazing larvae of the introduced *Sitona discoideus* coleopteran weevil. We have engineered *Sinorhizobium* to express a *Bacillus thuringiensis* endotoxin specifically in the nodule and are currently evaluating its effectiveness.

Giles Hardy, Treena Burgess and Gilbert Whyte are part of the Program for Australian Tree Health. They are studying insect pests of *Eucalyptus* plantations in Australia. Insect pests are a major threat to the emerging *Eucalyptus* plantation industry in Australia. Working on chrysomelids (*Monolepta australis*, *Chrysopharta varicollis*), weevils (*Gonipterus* spp.), and looking at direct impacts in association with fungal diseases, plant stress and their control, they are also investigating the biology, ecology and control of *Phorocantha* spp. in tuart (*Eucalyptus gomphocephala*) and insects associated with Tuart decline.

University of Western Australia, Ecology and Health group, School of Population Health

We are seeking to validate the hypothesis that human disease outbreaks can be used as a bioindicator of ecosystem disruption, and to identify appropriate interventions for preservation of ecological and, ultimately, human health. Human health is heavily dependent on ecological and environmental variables. It is also subject to more widespread and comprehensive surveillance compared to other available measures of ecosystem health. Using the example of mosquito-borne disease in Western Australia, we conducted a preliminary 'natural experiment' to assess the validity of this

hypothesis.

Recent Ross River virus activity in the Kimberley region of Western Australia points to an increased dry season mosquito-borne disease risk at Kununurra, independent of natural environmental variables. A mosquito sampling survey was conducted to determine the impact of ecosystem disruption arising from ongoing development of the Ord River Irrigation Area on dry season breeding of arbovirus vector mosquitoes. Significantly larger numbers and percentage of adult *Culex annulirostris*, important disease vectors, were collected within the irrigation area compared to nearby reference areas. Larval *Cx. annulirostris* were also collected at several sites within the irrigation area, whereas none were collected at reference areas. These results highlight the relationship between ecosystem disruption, mosquito breeding and associated disease incidence; and support the use of health data in identifying areas where local ecosystems have been disrupted.

While the anthropogenic disruption to the ecosystem at Kununurra is obvious, we intend to determine if more subtle ecosystem disruptions can be identified in a similar way. Entomological investigations of mosquito breeding and local disease transmission will be carried out in areas of potential ecosystem disruption identified using health notification data. We will then compare these results to similar investigations in areas of known ecosystem disruption and areas where the ecosystem has remained relatively undisturbed. This work will be carried out as part of PhD and post-doctoral research within Ecology and Health at the UWA School of Population Health in collaboration with the Mosquito Borne Disease Control Branch of the Department of Health, Western Australia.

COPY DEADLINE FOR NEXT ISSUE

Material for the November 2004 issue should reach **Tish Silberbauer** tsilberb@bio.mq.edu.au before **Friday 22 October 2004**.
Text as .rtf files; pictures as 300dpi .jpg files.

**THE AUSTRALIAN ENTOMOLOGICAL SOCIETY INC.
NOMINATION FOR MEMBERSHIP**

Please return to: Ms Nancy Endersby, AES Secretary, c/o Institute for Horticultural Development,
Private Bag 15, Ferntree Gully Delivery Centre VIC 3156 AUSTRALIA

We, the undersigned

Proposer
(print name) (signature)

Seconder
(print name) (signature)

being financial members of the Society, propose the following
for membership of the Australian Entomological Society Inc.

Title.....Initials.....Given name.....Family name.....

of (Address)

.....Post Code.....

Tel. Fax

E-mail Degrees, etc.

Interests, experience and publications in entomology for publication in the News Bulletin *Myrmecia*
(please attach brief resumé)

I accept nomination and undertake, if elected, to abide by the rules of the Society and to pay annual
subscriptions by the date prescribed.

Signature **Date**

For **2004**: Annual subscription \$110.00 (incl. GST); Electronic Journal only plus paper of or electronic
Myrmecia \$99 (incl. GST) (payment **MUST** be received by 31 January 2004 if you choose this option); full-
time student or retired members \$55.00 (incl. GST), joint membership \$115.50 (incl. GST).

Students please attach proof of full-time student status

Payment in Australian dollars is required with nomination and may be made by
MONEY ORDER, CHEQUE (made payable to Australian Entomological Society Inc.) or CREDIT CARD

Bankcard Visa Mastercard

Cardholder Name _____

Number _____

Expiry date __/__/__

Signature _____ I require a receipt

YES/NO

1000

1000

1000

1000

1000

1000

1000

1000